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Index issue

Biophysics, Bioengineering and Medical Instrumentation

Section 27
Abstracts no 3278-3687

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1 volume in 1974.

1. GENERAL ASPECTS

3278. Stereology: promise of a more quantitative microscopy - Robinson A.L. - SCIENCE 1974 185/4147 (243-244)

For the most part, stereology is a tool of science which is used in a rather routine manner by researchers in various disciplines whenever they have a problem requiring quantitative measurement of structure in 3 dimensions from 2 dimensional samples. A few investigators, however, are pushing the present limits of stereology into nonroutine applications and into new theoretical and instrumental capabilities.

3279. The freezing rate of freeze etch specimens for electron microscopy - Glover A.J. and Garvitch Z.S. - Phys. Engin. Lab., Dept. Sci. Industr. Res., Lower Hutt - CRYOBIOLOGY 1974 11/3 (248-254)

Experiments on the rapid freezing of freeze etch sized specimens have shown this rate between 0 and -100°C to be approximately 1000°C/sec. This is much faster than the rate of 100°C/sec estimated for specimens cooled in liquid Freon 12. Heat transfer from the rapidly immersed specimen and mount appears to be mainly through forced convection. Such a mechanism would make the initial rate highly variable as it would be sensitive to liquid velocity. If this occurs it will be impossible to obtain consistent results for freezing rate studies unless a stable method is evolved for both injecting and containing the specimen.

1.2. Components

3280. Polymer composites for use in orthopedic surgery - Lavelle F.J. and Johnson B.N. - UCLA, Los Angeles, Calif. 90024 - JBIOMECH. 1973 6/6 (651-655)

Since the use of acrylic cement for fixation of hip prosthesis components in 1950-51, a number of investigators have proposed various hip prosthesis designs using this cement fixation concept. This study was undertaken to support the hypothesis that certain dental materials could provide a more satisfactory bone prosthesis bond than that presently possible with acrylic bone cement. Two restorative resins were found to have superior strength and resistance to thermal degradation when compared to acrylic bone cement. Tests of acrylic cement combined with apatite fillers suggest that restorative resin anorganic bone composites would exhibit improved strength and toxicity properties and would also promote improved bonding due to resorption of the surface anorganic bone particles with subsequent bone infiltration and anchorage. Relatively high degradation of acrylic bone cement in accelerated aging tests suggests caution in using this material for implantation.

3281. The theory of antithrombogenic surfaces. First report - ZUR THEORIE DER ANTITHROMBOGENEN OBERFLAECHE. I. MITTEILUNG - Hildebrandt J. and

Schaps P. - Chir. Klin., Med. Akad. Carl Gustav Carus, Dresden - ZEXPCHIR. 1973 6/6 (355-361)

Properties of solids (mechanical quality of the surface, chemical reactivity, madeaction, and electric surface potential) exert an influence upon the relation between foreign body and blood clotting system. Considered separately, they are of no use for the judgement of thrombogenic or antithrombogenic properties of foreign bodies. These properties must be considered as complex. They are certainly not sufficiently described by the factors mentioned. Now as before, biologic examination is necessary for the determination of the thrombogenic properties of foreign bodies.

3282. Tensile bond strength between fissure sealants and enamel - Williams B.F., Von Fraunhofer J.A. and Winter G.B. - Dept. Child. Dent., Inst. Dent. Surg., Univ. London - J.DENT.RES. 1974 53/1 (23-27)

Acrylic buttons were attached to tooth enamel by in situ curing of 3 types of polymeric fissure sealants, a dental cement, and a glass ionomer cement, and then were immersed in water. The polymeric materials exhibited the greatest bond strengths to enamel, but in 2 instances the bond strength decreased with time, although the cements showed increased strength. One polymeric material exhibited an unchanged bond strength.

3283. Sensitization still a problem in the intergranular corrosion of stainless steel surgical implants - Tennese W.W. and Cahoon J.R. - Dept. Mechan. Engin., Metallurg. Sci. Lab., Univ. Manitoba, Winnipeg - BIOMAT.MED.DEV.ARTIF.ORGANS 1973 1/4 (635-645)

Routine metallurgical examination of surgical implants removed from patients in 1970 revealed that 4 osteotomy plates had suffered extraordinary amounts of corrosion. A typical metallurgical examination for one of the plates is reported. Standard tests showed that the corrosion was a result of sensitization, a well known problem with stainless steels. The results of this investigation indicate that the manufacture of stainless steel implants should be more rigidly controlled.

3284. The creep of dental amalgam. A factor determining the loss of an amalgam filling and its surrounding structure - Vrijhoef M.M.A. and Driessens F.C.M. - Dept. Dent. Mat. Sci. Technol., Univ. Nijmegen - BIORHEOLOGY 1974 11/3 (191-196)

This paper describes experiments on the steady state creep rate of 6 dental amalgams and its dependence on applied stress and deformation temperature. It was found that both the experimental results reported in this article and the experiments reported in literature could be described satisfactorily by the equation: $\dot{\epsilon} = K(\sigma - \sigma_0) \exp(-U/kT)$. In this equation $\dot{\epsilon}$ is the steady state creep rate, σ is the applied stress, σ_0 is an internal stress component, U is the activation energy, T is the temperature (K), K is a constant and k is the Boltzmann constant. No differences could be detected between the mean values of the activation energies of the 6 amalgams, the overall mean being 108.5 kJ/K mole. Furthermore, $b =$

IK $\exp(-U/295.5 \text{ k}) \exp(-1/2)$ was found to be independent of the mercury content (i.e. the quantities of the low melting phases γ_1 and γ_2). Within the experimental error b was found to be independent of the ratio of the volume fractions of the γ_1 and γ_2 phase. It was concluded that the most probable phase which determines the value of b is the γ_1 phase.

3285. Implant evaluation of a nuclear power

source: Betacel battery - Ko W.H. and Hynecek J. - Engin. Design Cent., Case West. Reserve Univ., Cleveland, Ohio 44106 - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (238-241)

In order to evaluate nuclear power sources for biomedical applications, a nuclear battery was used to power two telemetry transmitters designed with very low power consumption. The transmitters were implanted in a dog to measure the voltage of the battery and the deep body temperature. Special care was given to the glass packaging to prevent possible damage from body fluids. The experiment ran continuously for a 6 mth period before termination. At that time, the animal was sacrificed to examine the radiation damage of tissues in the vicinity of the transmitters as well as the effects on vital organs. No measurable abnormality was detected. The experiment suggests that the nuclear power source can be used to extend the working life of implanted medical instruments.

3286. A new method to measure the figure of merit of microwave detector diodes - Cohn

Sfetcu S. and Buckmaster H.A. - Phys. Dept., Univ. Calgary - IEEE TRANS.INSTRUMENT.MEASUREMENT 1974 IM 23/1 (102-103)

It is shown that the figure of merit of microwave detector diodes can be measured directly using a noise measurement technique based on digital Fourier analysis. This technique enables the operating conditions of these diodes to be optimized while used as an in situ part of an instrumentation system.

3287. The thermal rating of metallized film capacitors under pulse conditions - Geen J.A. -

Erie Electron. Ltd., South Denes, Great Yarmouth - RADIO ELECTRON.ENGINEER 1974 44/4 (218-226)

Simple expressions are derived for the power dissipation in metallized film capacitors under some common pulse current conditions. Using these, the sinusoidal current ratings may be used to estimate the suitability of the capacitors for pulse applications. Tables are given to facilitate the use of the results.

3288. Transistor gain boosts capacitor value -

Schmutz L.E. - MIT, Cambridge, Mass. - ELECTRONICS 1974 47/15 (116-117)

In many applications, designers try to avoid specifying large capacitors. Besides being expensive, they are usually leaky, have poorly toleranced values, and are physically large. But such large capacitor problems as these can be circumvented by using the gain of a transistor to multiply capacitance. As shown, a simple circuit will do the job, allowing a much smaller capacitor to be used instead.

2. BIOPHYSICS AND BIOENGINEERING

3289. Ciphers and biological evolution - LES

NOMBRES ET L'EVOLUTION BIOLOGIQUE - Meidinger F. - CYBERNETICA 1973 16/2 (136-155)

Graphs have been compiled to tabulate the heart rates and respiratory rates of all animals in general, and of each group of animals in particular. The results in the latter case have been examined with a view to equating them to evolution.

3290. Cell space approaches in biomathematics -

Kitagawa T. - Res. Inst. Fundam. Informat. Sci., Fac. Sci., Kyushu Univ., Fukuoka - MATH.BIOSCI. 1974 19/1-2 (27-71)

The primary purpose of this paper is to explain some principal aspects of various approaches appealing to certain mathematical formulations based upon cell spaces and to illustrate their implications to biomathematics. In Sects. 2 and 3 the authors explain specific investigations on cell space in connection with a family of local transformations satisfying the principle of local majority. In Sect. 4 general considerations and a set of 5 interpretations of basic notions of cell space approaches are given to explain how and why an abstract and purely mathematical formulation of cell space can have any connection with biological problems and hence can deserve to be a theoretical framework in biological sciences. The general attitude given in Sect. 4 is illustrated in Sect. 5 in which various biological problems, including birth, growth, formation of forms, pattern disintegration, and death, as well as some ecosystem problems are discussed with reference to various works done by many authors. Suggestions are given regarding the problem of what notions will be indispensable to further investigation of the cell space approach. In Sect. 6 the author summarizes the view on the role of biomathematics which is to be expected to have a certain role different from biophysical consideration. It is the standpoint of the author to build up a branch of biomathematics which is closely and directly connected with the information science approach, as is explained in Sect. 7, with specific reference to the automation and language problem in the cell space approach.

3291. Calcium homeostasis: responses of a

possible mathematical model - Powell T. and Valentinuzzi M.E. - Dept. Phys. Appl. Med., Middlesex Hosp. Med. Sch., London - MED.BIOENGINEERING 1974 12/3 (287-294)

By using qualitative physiological information, a linear and simplified mathematical model of the calcium homeostatic mechanism is presented. Three simultaneous equations in the s domain are obtained and describe the concentration of plasma Ca, plasma thyrocalcitonin and plasma parathormone, from which theoretical responses can be derived for 7 different cases, and 2 different types of control. These cases are summarised as: Ca response to I.V. Ca injection, thyrocalcitonin response to I.V. Ca injection, parathormone response to I.V. Ca

injection, perfusion of thyroid with Ca, perfusion of parathyroid with Ca, parathormone response to thyrocalcitonin injection and thyrocalcitonin response to parathormone injection. The model suggests some avenues for experimentation and is also suitable for computer simulation.

3292. Recent progress in stagraphics -

Capobianco M. - St. Johns Univ., Staten Island, N.Y. 10301 - ANN.N.Y.ACAD.SCI. 1974 Vol. 231 (139-141)

Stagraphics is a term the author coined for the study of problems of statistical inference in graphs. A finite population in which the individuals bear some relationship to one another is represented by a graph or digraph (directed graph), e.g. a social group, an organizational structure, a food chain. The problem is that one cannot observe the entire graph, and statistical inferences about some aspect or other of the graph must be made on the basis of a sample consisting of one or more subgraphs. The variety of possible problems is enormous. It is the purpose of this paper to give a brief report of the work that has been done, published or not, since the appearance of the first paper on the subject, and to indicate possible future directions. Essentially 3 problems have been considered, and one other is now under study. These are cycle detection, estimation of connectivity, estimation of the number of components of a forest, and testing for connectedness.

3293. Some measures of information arising in statistical games -

Gottinger H.W. - Univ. California, Santa Barbara, Calif. - KYBERNETIK 1974 15/2 (111-116)

This paper discusses some measures of information which naturally arise in the context of statistical games (games against nature). Some useful inequalities are proven which relate the entropy to the value of information provided by experiments. Two other measures, one based on the notion of a metric as informational distance and the other on that of a diameter value, are also discussed.

3294. An asymptotic unbiased technique for estimating the error rates in discriminant analysis -

McLachlan G.J. - Dept. Mathemat., Univ. Queensland, St. Lucia - BIOMETRICS 1974 30/2 (239-249)

A new technique for estimating the error rates in discriminant analysis is suggested. The estimates obtained using this technique are asymptotically less biased than existing estimates. The performance of this technique on the basis of criteria other than that of bias is studied using Monte Carlo methods to simulate practical situations and also the criterion of asymptotic mean square error. The all round performance of this technique is comparable to that of any other available technique.

3295. Treatment of exponential phenomena in biophysics -

TRAITEMENT DES PHENOMENES EXPONENTIELS EN BIOPHYSIQUE - Lipnik P. - Inst. Phys. Corpuscul., Univ. Louvain - RADIAT.ENVIRON.BIOPHYS. 1974 11/2 (145-156)

A technique using convolutional integrals of exponential functions was applied to experimental

data. The mathematical model was developed for physical and biomedical measurements, where the instrumental resolution and/or the natural dispersion of the phenomena must be taken into account.

3296. Iodipamide kinetics in the dog: a

multicompartmental analysis - Shames D.M. and Moss A.A. - Nucl. Med. Sec., Dept. Radiol., Univ. California, San Francisco, Calif. 94143 - INVEST.RADIOL. 1974 9/3 (141-148)

A compartmental model is formulated describing the distribution and transport kinetics of adipiodone in the unanesthetized dog. The model describes adipiodone kinetics in the plasma, liver and an extravascular pool. Data used in the development of the model included the plasma disappearance and bile output rate of adipiodone iodine following bolus injection. Salient features of the model include a rapid distribution volume of about 12% of body weight, a total plasma adipiodone clearance of 1.5 ml/min/kg of which 80% is by liver and 20% by kidney, a net hepatic extraction fraction for adipiodone of about 12%, hepatic reflux back to plasma 3 times greater than biliary excretion and a hepatic to plasma concentration ratio which peaks at about 4.0. The model has proved useful in suggesting some metabolic properties of adipiodone not previously described in the literature and in prompting new experiments to corroborate the implications of the model.

3297. On incremental algorithms for averaging and correlation computation -

Ojala L. and Rautanen E.T. - Dept. Electr. Engin., Helsinki Univ. Technol., Otaniemi - IEEE TRANS.INSTRUMENT.MEASUREMENT 1974 IM 23/1 (90-94)

Exact incremental algorithms were developed for computing the mean and the correlation functions of time signals. Corresponding special purpose computer organizations for a recursive averager and correlator are suggested.

3298. A program for the analysis for compounded functions of categorical data -

Forthofer R.N. and Koch G.G. - Sch. Publ. Hlth, Univ. Texas, Houston, Tex. 77025 - COMPUT.PROGR.BIOMED. (Amst.) 1974 3/5 (237-248)

A computer program is described which uses the minimum modified chi square method of estimation and testing in the analysis of compounded functions of categorical data. The program allows a model to be fitted and obtains weighted least squares estimates of the model parameters. Tests of hypotheses can be performed by partitioning the sum of squares (similar to ANOVA). A complete discussion of the problem is given, along with several numerical examples.

3299. Interactive data sorting and evaluation

program for chemical relaxation experiments - Czerlinski G.H., Kobbe R. and Tatti K. - Dept. Biochem., Northwest. Univ., Chicago, Ill. 60611 - COMPUT.PROGR.BIOMED. (Amst.) 1974 3/5 (267-277)

A program is described for the evaluation of repeated sets of data from chemical relaxation experiments. The combining logic for repeated sets is described as well as various editing features (for example: elimination of points

beyond a certain error limit). The program should be run in the interactive mode from a teletypewriter. Plots of combined data sets are produced at will and an averaging option is also available.

3300. Analog computer simulation of active and passive Na flux in Necturus proximal tubule - Bentzel C.J., Spring K.R., Hare D.K. and Paganelli C.V. - Dept. Med., State Univ. New York, Buffalo, N.Y. 14215 - *AMER. J. PHYSIOL.* 1974 226/1 (127-135)

An analog computer model is proposed for simulation of Na fluxes in Necturus proximal tubule based on the time course of split drop expansion following intraluminal injection of a Na free drop made isosmotic to plasma with an impermeant solute. Assuming a single rate limiting membrane, the model predicts that Na permeability can be determined exclusively by the initial rate of drop volume expansion. As drop Na concentration increases, active efflux, expressed as the product of a rate constant, and drop Na concentration become increasingly important in determining steady state volume and the time required to reach this volume. The analog model applied to experimental observations: describes the time course of drop expansion under normal conditions, during partial metabolic inhibition of active transport, and during expansion of the animals extracellular volume; predicts drop steady state Na concentration; predicts active efflux expressed as an electrical driving force. The authors conclude that quantitation of bidirectional transepithelial Na fluxes can be obtained with standard micropuncture data analyzed by a simple pump leak model.

3301. Incompatibility alleles; characteristics of a 1 locus system - Hagander P. and Johansson L. - Div. Automat. Contr., Lund Inst. Technol., Lund - *MATH. BIOSCI.* 1974 20/1-2 (145-154)

The 1 locus incompatibility system that is usually assumed to be present in the red clover is investigated. The allele fluctuations from one generation to the other are demonstrated. A mathematical state model is deduced for arbitrary numbers of alleles in the population, and its steady state behavior and stability are discussed. The eigenvalues of the linearized models as well as simulations show that the large systems react slowly to disturbances while the 3 allele system oscillates around its equilibrium.

3302. Optimal allocation of time in resource harvesting - Levine S.H. - Electr. Computer Engin. Dept., Univ. Massachusetts, Amherst, Mass. 01002 - *MATH. BIOSCI.* 1974 20/1-2 (171-178)

A mathematical model is developed to determine the optimal allocation of time in resource harvesting. Particular emphasis is placed on the influence of search time and competition on optimal niche width. Increased search time and intraspecific competition are shown to favor broader niches. Increased interspecific competition places opposing demands on a species, favoring broader niches due to increased search time and narrower niches to overcome diffuse competition.

3303. On the propagation theory for bands of

chemotactic bacteria - Rosen G. - Drexel Univ., Philadelphia, Pa. 19104 - *MATH. BIOSCI.* 1974 20/1-2 (185-189)

By exhibiting exact analytical expressions for the planar wave solutions to the governing equations, it is shown that the theory for the propagation of bands of chemotactic bacteria requires an effective mth order process for the degradation of the critical substrate chemotactic agent, with m less than unity but greater than a certain function of the diffusional transport coefficients.

3304. Mathematical modeling of a virus vector: Culex tarsalis - Juricic D., Eno B.E. and Parikh G. - Dept. Mechan. Engin., South Dakota State Univ., Brookings, S.D. - *BIOMED. SCI. INSTRUMENT.* 1974 Vol.10 (23-28)

A mathematical model of the population dynamics of Culex tarsalis mosquitoes, the primary vector of western equine encephalitis (WEE), was developed. All known facts about development in the aquatic phases and the different stages in the adult female gonatrophic cycle, as influenced by daily temperature fluctuation, humidity, wind and rainfall, are incorporated in the model. The spatial account of a flight range was included by considering the breeding site as it changes through the season due to given rainfall and other weather conditions. Climatological data pertaining to a breeding site typical of Brookings County, South Dakota was used for an illustrative computer run of the model.

3305. On some stochastic models for protein biosynthesis - Hiernaux J. - Fac. Sci., Univ. Libre, Bruxelles - *BIOPHYS. CHEM.* 1974 2/1 (70-75)

The stability of the solutions of a model proposed by Gibbs et al. to describe the protein biosynthesis is studied in terms of the relative values of the kinetic parameters characterizing the three main steps of the polymerization process, i.e., initiation, elongation and termination. When the rate of initiation is equal to the rate of termination, the stationary state is unstable and depends thus on the perturbations imposed on the system. A comparison with results established by Vassart et al. suggests that initiation could be the rate determining step in protein biosynthesis.

3306. A model for phase transitions in lipid bilayers and biological membranes - Scott Jr H.L. - Dept. Phys., Oklahoma State Univ., Stillwater, Okla. 74074 - *J. THEOR. BIOL.* 1974 46/1 (241-253)

An order disorder model is presented for the observed phase transitions in lipid bilayers and biological membranes. The model may, under certain circumstances, exhibit two phase transitions, one corresponding to positional disordering of entire lipid molecules, and the other corresponding to orientational disordering in the hydrocarbon chains. Numerical analysis of the model is given and compared with experimental data. Shortcomings of the model and future directions for analyses of this type are also discussed.

3307. A biological homology inference from

ergodic theory - Foias C. - Inst. Mathemat., Bucharest - J.MATHBIOL. 1974 1/1 (3-7)

It is shown that if a living being needs to extract a certain average amount H_m of information from nature, then the number m_n of its sensors depends only on H_m , i.e. m_n is independent of the environment.

3308. The zygotic algebra for sex linkage - Woerz Busekros A. - Lehrst. Biomathemat., Univ. Tübingen - J.MATHBIOL. 1974 1/1 (37-46)

The zygotic algebra for sex linkage with multiple alleles contains an ideal which is a baric algebra. This ideal possesses at least one idempotent with non negative coefficients. For the mutation case and the case of simple Mendelian inheritance in the female sex convergence theorems are proved for the sequence of plenary powers of a normalized element. For these two cases it is shown that the ideal in question is a special train algebra.

3309. On the equilibrium states in certain selection models - Haderl K.P. - Lehrst. Biomathemat., Univ. Tübingen - J.MATHBIOL. 1974 1/1 (51-56)

The Fisher Wright Haldane model describes the behavior of a diploid population with random mating and separated generations under selection. Similar models for overlapping generations were investigated. The corresponding differential equations for gene frequencies were derived under the hypothesis that the population as a whole was in Hardy Weinberg equilibrium. This hypothesis cannot be satisfied in actual populations. A system of equations for the genotype frequencies was derived without this hypothesis. It can be shown that the equations for gene frequencies yield an appropriate description (at least in the neighborhood of an equilibrium) if the differences in fitness result from differences in fertility rather than mortality.

3310. Numerical taxonomy with fuzzy sets - Bezdek J.C. - Cent. Appl. Mathemat., Olin Hall, Cornell Univ., Ithaca, N.Y. 14850 - J.MATHBIOL. 1974 1/1 (57-71)

A recently developed fuzzy clustering technique is utilized to analyze the substructure of a well known set of 4 dimensional botanical data. A solution obtained without prior knowledge of labelled pattern structure is offered in support of the contention that the technique proposed affords a comparatively reliable criterion for a posteriori evaluation of cluster validity.

3311. Computer construction of isokinetic sucrose centrifugation gradients - Vollmer R.T. - Dept. Pathol., Duke Univ. Med. Cent., Durham, N.C. 27710 - COMPUTERS BIOMEDRES. 1974 7/3 (189-199)

The mathematical framework of isokinetic sucrose density gradients for the ultracentrifuge is discussed, and based on this development a highly automated computer program to calculate those gradients is presented. The program utilizes the iterative chord method and Marquardt's NLIN program to respectively calculate and fit the isokinetic gradient to a gradient making apparatus function.

3312. Optimal control of a prey predator system - Goh B.S., Leitmann G. and Vincent T.L. - Sch. Mathemat., Univ. New South Wales, Kensington - MATHBIOSCI. 1974 19/3-4 (263-285)

The purpose of this contribution is to illustrate the use of optimal control theory to obtain optimal strategies for the control of a prey predator system. Two types of control variables are used. One control variable is the rate of release of predators or preys which are bred in laboratories. The other type of control variable is the rate of application of an insecticide. An interesting and unexpected result is that it is feasible to control a pest by means of an insecticide that destroys only the predators but leaves the pests unharmed. This is because the prey predator system is a dynamical system. The level of the control variable and the timing of its application can be manipulated to produce the desired responses from the dynamical system. Another interesting result is that the system can be controlled by releasing pests which have been bred in laboratories. These results may be useful in formulating an integrated control scheme for the management of a pest.

3313. The effect of the length of incubation period on the velocity of propagation of an epidemic wave - Radcliffe J. - Queen Mary Coll., Univ. London - MATHBIOSCI. 1974 19/3-4 (257-262)

Using the approximation that the density of susceptibles remains constant, an expression for the velocity of propagation of an epidemic with a negative exponential incubation period is determined.

3314. On the populations of competing species - Brauer F. - Mathemat. Dept., Univ. Wisconsin, Madison, Wis. 53706 - MATHBIOSCI. 1974 19/3-4 (299-306)

The population sizes of 2 species competing for the same food supply or living space are often modeled by a pair of ordinary differential equations. If the growth rates of the 2 population sizes are linear in the population sizes, then coexistence in stable equilibrium implies qualified competition at equilibrium, in the sense that the effect of the competition is to increase the total population. Since experiments indicated that a stable equilibrium with unqualified competition was possible, this suggests that non linear growth rates would give a more accurate model. An example is given of a model with non linear growth rates which exhibits a stable equilibrium with unqualified competition.

3315. Pharmacokinetics with uncertainties in rate constants. III: The inverse problem - Soong T.T. and Dowdee J.W. - Dept. Engin. Sci., State Univ. New York, Buffalo, N.Y. 14214 - MATHBIOSCI. 1974 19/3-4 (343-353)

The identification of a random compartmental model from kinetic data in pharmacokinetics is considered, where the randomness arises due to uncertainties in our knowledge of the rate constant. An identification scheme together with computational algorithms for estimating the properties of the random constants is presented. A 2 compartment model is used as an example, and the problem of

identification based upon incompletely observed data is commented upon. The results also show that, if the underlying model is actually random, serious degradation in results can be expected if it is incorrectly modeled as deterministic.

3316. Limit theorem for critical branching diffusion processes with absorbing barriers - Hering H. - Inst. Mathemat. Statist., Univ. Karlsruhe - *MATHEBIOSCI.* 1974 19/3-4 (355-370)

In its present shape the limit theory for critical, irreducible Markov branching processes with arbitrary set of types and finite second moments does not apply to branching diffusion processes with absorbing barriers. The occurrence of absorbing barriers is incompatible with the condition of uniform positivity imposed on one of the eigenfunctions associated with the moment semigroup. Taking into account certain asymptotic spectral properties of the differential operator generating the moment semigroup of a branching diffusion process, the deficiency can be overcome to some extent by a modification in treatment. The authors demonstrate this for a branching process of Brownian particles restricted to a one dimensional finite interval with totally absorbing barriers at the endpoints.

3317. Restoration of hum contaminated correlation functions - Mikulski A.T. and Seifritz W. - Inst. Kerntechn., Techn. Univ. Hannover - *NUCL. INSTRUM. METH.* 1974 117/2 (405-408)

Two calculation procedures for restoring hum contaminated correlation functions are presented. The first method is based on a forward backward Fourier transformation which removes hum contributions in the power spectral density function. The second approach is based on a digital filtering technique in the time domain with the help of an algorithm based on a notchtype filter in the frequency domain, whose zeros coincide with frequencies of direct or aliased hum peaks. Both methods are applied to an experimental example, thus demonstrating both the necessity and the usefulness of such techniques in practice.

3318. A discrete time stochastic growth process for human populations accommodating marriages - Mode C.J. - Inst. Populat. Stud., Drexel Univ., Philadelphia, Pa. 19104 - *MATHEBIOSCI.* 1974 19/3-4 (201-219)

A discrete time stochastic growth process for human populations accommodating marriages is introduced. In the introduction the motivations underlying the formulation of the model are discussed and the basic random functions of the process are defined in Sec.2. The basic random functions of the model change because of deaths, marriages, the dissolutions of couples, and births, and Sects. 3, 4, 5, and 6 are devoted to stochastic processes describing these aspects of population dynamics. Finally, Sec.7 is devoted to the derivation of a system of nonlinear renewal type equations satisfied by the mean functions of the process. The techniques used in the construction of the population process introduced in this paper are related to those used in the construction of multitype age dependent branching processes.

3319. A map technique for identifying variables of symmetry - Goodrich L.M. - Bell Lab., Murray Hill, N.J. - *BELL. SYST. TECHN. J.* 1974 53/5 (801-826)

This paper presents a new map technique for identifying symmetrizable functions. The technique greatly reduces the work in ascertaining symmetry, and it is unique in being also applicable to completely or incompletely specified functions which contain imbedded symmetrizable functions, are the complement of a function of type(i), and contain an imbedded function of type(ii). Discussion of the technique and its extensions is included.

3320. Measuring a mitotic oscillator: the arc discontinuity - Kauffman S. - Dept. Theoret. Biol., Univ. Chicago, Ill. 60637 - *BULL. MATH. BIOL.* 1974 36/2 (171-182)

Mitosis occurs synchronously in up to 10^4 nuclei in the syncytial plasmodium of *Physarum polycephalum*. Any two phases of the mitotic cycle may be mixed by fusing plasmodial pairs. A topological property of the synchronized phase of the fused pair as a function of parental phases, the arc discontinuity characterizes the underlying oscillator, and indicates mitosis is controlled by a moderate relaxation oscillator which rotates more rapidly near its singularity than its limit cycle. A model oscillator is briefly described.

3321. Stability and enzyme separation: integral representation of the solutions - Thames Jr H.D. - Biomathemat. Dept., M.D. Anderson Hosp., Univ. Texas, Houston, Tex. 77025 - *BULL. MATH. BIOL.* 1974 36/2 (197-203)

Two enzymes, cross coupled through their respective products, are membrane bound and thereby separated from each other. The cross coupling is of opposite character and diffusion limited, i.e. an activation inhibition couple with a diffusion induced time lag. In this paper an integral representation for the solutions of the dynamic equations is developed using the Greens function technique, and an application to morphological changes in the mitochondrion is discussed.

3322. Binary sequences and redundancy - Kak S. - Dept. Electr. Engin., Indian Inst. Technol., New Delhi - *IEEE TRANS. SYSTEMS MAN CYBERN.* 1974 smc-4/4 (399-401)

The computational complexity approach and entropy using nominal frequencies lead to different measures to characterize patterns in finite binary sequences. These were compared to a measure obtained on taking integral transforms of the sequences. The transforms considered by the author were the Walsh and the discrete Legendre. He found pattern characterization through integral transforms to be intuitively satisfying. In particular, Walsh transform characterization appeared natural for binary sequences, as did the use of discrete Legendre transforms for more general (nonbinary) sequences.

3323. Identification of viable biological strategies for pest management by simulation studies - Menke W.W. - Coll. Business Adm., Univ. Florida, Gainesville, Fla. 32611 - *IEEE TRANS. SYSTEMS MAN CYBERN.*

Interdisciplinary research has developed a stochastic computer model for studying interactions between an insect population, its host food crop, and other variables. This population growth model, highly adaptable to any insect and any host crop, is technically characterized by discrete arrivals, infinite servers, and multistage continuous service time distribution functions. Because steady state is seldom achieved in nature, this paper identifies combinations of critical starting conditions (number of insects and disparate start times for insects and host crops), and critical stages for induced survival rate reductions to minimize crop damage. Sensitivity analyses serve to identify the most promising areas for future entomological research in pest management strategies.

3324. Cross spectrum error criterion as an image quality measure - Tescher A.G. and Parsons J.R. - Aerospace Corp., Los Angeles, Calif. 90045 - *APPL.OPT.* 1974 13/6 (1460-1465)

Various criteria have been considered for image quality measure. Some of these involve subjective human visual evaluation, while others rely on statistical techniques. In this paper, a cross spectrum error criterion is considered as a distortion measure for undersampled band limited images. The effect of undersampling, aliasing on the perfect image, was demonstrated by manipulation in the frequency domain. Subjective comparison of the digital simulation resulted and the appropriate calculated spectral error indicated that the latter was a useful quantity for the analysis of distortion present in undersampled images. Relevance of the authors analysis to spatial filtering experiments and the mean square error is also discussed.

3325. A generalized method for matching informational macromolecular code sequences - Wong A.K.C., Reichert T.A., Cohen D.N. and Aysun B.O. - Biotechnol. Program, Carnegie Mellon Univ., Pittsburgh, Pa. 15213 - *COMPUT.BIOL.MED.* 1974 4/1 (43-57)

The major outlines of an exhaustive algorithm which discovers the optimal correspondence of a pair of code strings from a prespecified alphabet is presented. The measure of the quality of correspondence is the information required to effect the mutations indicated by the correspondence. This formulation is shown to lead naturally to expressions for the penalty for introducing gaps, an ad hoc feature of previous approaches. The limitations of earlier algorithms of this type are delineated, and a non trivial example of the matching of 2 partial sequences of Tyrosyl tRNA from *E.coli* and Bakers yeast is given.

3326. Computer analysis of photochemical changes in the human retina - Ripps H. and Snapper A.G. - Dept. Ophthalmol., New York Univ. Sch. Med., New York, N.Y. - *COMPUT.BIOL.MED.* 1974 4/1 (107-122)

The first stage of the visual process involves the absorption of quanta by light sensitive pigments in the retinal receptors. The photochemical consequences of this event can be

measured *in vivo* by the technique of fundus reflectometry, and rapidly analyzed by a computer. This paper describes the principles of fundus reflectometry and considers the programming requirements for on line data acquisition and processing of analog signals in a small laboratory computer.

3327. An analysis of Forrester's world dynamics model - Cuyppers J.G.M. and Rademaker O. - Project Global Dynamico, Techn. Hogesch., Eindhoven - *AUTOMATICA* 1974 10/2 (195-201)

The World Dynamics model proposed by Forrester is analysed by total linearisation for the 1970 situation. It reveals the main structure of the model for a certain period of time around 1970. This structure has been verified by means of the original Forrester model, and a number of interesting conclusions about this model are drawn.

2.1. Fundamental concepts

3328. The problem of arrest in cell models of growth - Varshavskii V.I., Marakhovskii V.B. and Peschanskii V.A. - Leningrad Div., Cent. Econ. Mathemat. Inst., USSR Acad. Sci., Leningrad - *BIOPHYSICS* (Oxford) 1973 18/3 (555-565)

A cell automat model of arrest of growth is considered. The problem is raised as to the size of the configuration which can be grown in a homogeneous cellular space with a fixed complexity (number of states) of the cells. For an elementary - linear cell space an evaluation is presented of a length of the configuration obtained.

3329. Josephson junction detectors. Josephson devices are sensitive detectors of magnetic fields, voltages, and far infrared radiation - Clarke J. - Dept. Phys., Univ. California, Berkeley, Calif. 94720 - *SCIENCE* 1974 184/4143 (1235-1242)

Josephson tunneling is a phenomenon of very great fundamental physical interest and also of diverse and far reaching application. A very precise measurement of e/h which has had considerable impact on the values of many of the fundamental constants has already been seen. The National Bureau of Standards now maintains the standard volt in terms of a Josephson frequency. The use of Josephson junctions in computers offers the possibilities of increased speed and reduced size. The use of SQUIDs provides unprecedented resolution in the measurement of low frequency voltages, magnetic fields, field gradients, and susceptibilities. This particular area is presently one of rapid growth, largely because of the availability of SQUIDs commercially. Thus scientists formerly unconnected with low temperature physics are now able to take advantage of the great sensitivity of SQUIDs. It seems very likely that these devices will be used in other fields to an increasing extent. Finally, the Josephson junction has considerable promise as a broadband detector and as a heterodyne detector in the far infrared.

3330. Change in the permeability of modified

bimolecular phospholipid membranes on periodic stretching - Pasechnik V.I. and Sokolov V.S. - Phys. Fac., Lomonosov Moscow State Univ., Moscow - BIOPHYSICS (Oxford) 1973 18/4 (698-704)

The authors investigated change in the impedance of the modified bimolecular phospholipid membrane (b.p.m.) with periodic change in the area of the membranes. It was found that a sufficiently rapid change in the area of the b.p.m. was accompanied by its stretching leading to a change in the permeability of the modified b.p.m. Change in the permeability depends on the properties of the membrane and the tension applied to it. The phenomenon observed may be regarded as a model of the primary acts of mechano reception.

2.2. Mechanical systems

3331. Biomechanics and sports. Accelerations occurring in the human body on different movements on different surfaces - BIOMECHANIK

UND SPORT. UBER BESCHLEUNIGUNGEN DIE AM MENSCHLICHEN KÖRPER BEI VERSCHIEDENEN BEWEGUNGEN AUF VERSCHIEDENEN UNTERLAGEN AUFTRETEN - Nigg B., Neukomm P.A. and Unold E. - Lab. Biomech., ETH, Zurich - ORTHOPAED 1974 3/3 (140-147)

Acceleration (vibration) during walking, running and skiing was measured on the shin (tibia), hip and head and transmitted by means of a 7 channel telemetry apparatus. The results provide information on the slowing down properties of the human motor apparatus during various movements supported in various ways. In walking and running the leg values on the different ground surfaces vary considerably. The highest measured values on the leg were recorded on a synthetic sports ground surface and on asphalt. But no significant difference was found as regards the hip values. This result indicates that the legs carry the heaviest burden on synthetic surfaces. In skiing, while the leg values are considerably higher than in walking and running, the hip values are of the same order of size. This means that the legs have to absorb significantly more energy in skiing than in walking and running. The measured values can be influenced to a great extent by different skiers and by different footwear.

3332. Analysis of a simple prototypal muscle model near to and far from equilibrium - Chen Y.D. and Hill T.L. - Lab. Molec. Biol., Nat. Inst. Arthr. Metab. Dig. Dis., NIH, Bethesda, Md. 20014 - PROCNATACADSCIUSA 1974 71/5 (1982-1986)

Accurate calculations of force generated and of ATP flux, in steady isotonic contractions, are made on a simple, two state muscle model of the sliding filament type. The objective is to illustrate the proper formulation and use of a complete and self consistent molecular model of muscle. Otherwise, the model is not meant to be realistic. Calculations were made near equilibrium, including linear and quadratic terms in a power series expansion, and arbitrarily far from equilibrium by direct numerical solution of the appropriate differential equation in the probability of cross bridge attachment. The

results obtained from the two different methods agree where they overlap near equilibrium. The efficiency of free energy conversion is emphasized, and the relation to linear irreversible thermodynamics is pointed out.

3333. On the dynamic stability of biped locomotion - Gubina F., Hemami H. and McGhee R.B. - Dept. Electr. Engin., Ohio State Univ., Columbus, Ohio 43210 - IEEE TRANS.BIOMED.ENGNG. 1974 BME 21/2 (102-108)

While biped locomotion involves very complicated dynamical processes, a good deal can be learned about stability and feedback control from an analysis of simplified mathematical models. This paper treats locomotion dynamics relative to planar motion under an assumption that leg mass can be ignored in comparison to body mass. Thus the hypothetical biped possesses one rotational degree of freedom and two translational degrees, leading to a sixth order system of nonlinear differential equations. These equations are linearized and feedback control laws are then derived to produce the desired stable forward motion. The feedback laws proposed involve a combination of continuous and discrete concepts to produce both step length and step period control, as well as control of body attitude and altitude. The applicability of the control laws to the nonlinear system in the presence of large disturbances is verified by computer simulation. Hopefully, the results presented are significant in relation to control processes arising in lower extremity prostheses and orthoses, as well as to the design of biped robots.

3334. Autoconsistency in ventilatory mechanics - Vezzoli F., Pelosi V., Mignone V. et al. - Osp. Maggiore, Milano - RESPIRATION (Basel) 1974 31/3 (221-239)

The reliability was tested of a generalization of the electric network scheme in ventilatory mechanics, using as input a set of compartments derived from washout curves and comparing output with effective compliance, resistance and cumulative phase lag between applied pressure and volume inflation.

3335. Compression test on the weight bearing capacity of the femoral head of rabbits - DRUCKPROBE ZUR BEURTEILUNG DER TRAGFAHIGKEIT DES FEMURKOPFES IN TIERVERSUCHEN - Szepesi K. and Kapitany S. - Orthop. Klin., Med. Univ., Budapest - ARCHORTHOPUNFALL-CHIR. 1974 79/1 (21-28)

A compression test performed on the femoral head of rabbits is described in order to determine some mechanical characteristics concerning the weight bearing capacity of the proximal epiphysis of the femur. According to the authors' method the changes of the mechanical behaviour of an experimentally damaged epiphysis are determined by comparison of the values obtained on the operated and on the untreated control femur of the same animal. The method will be used to estimate the influence of experimental avascular necrosis of the proximal femoral epiphysis on the weight bearing capacity of the femoral head. In present control series maximal differences between the values of the

main parameters determined on both femora of 20 untreated animals were less than 15% (the breaking force and the limit of elasticity), respectively 30% (the degree of elasticity and the elastic deformation).

3336. Wave transmission characteristics and anisotropy of canine carotid arteries - Moritz W.E. and Anliker M. - *Cent. Bioengin., Univ. Washington, Seattle, Wash.* 98195 - *JBIOMECH.* 1974 7/2 (151-154)

A method was developed to generate and record 3 types of small amplitude waves (pressure, torsion and axial) in the exposed carotid artery of anesthetized dogs. The pressure waves were studied with the aid of miniature pressure transducers; electro optical tracking units monitored the axial and circumferential surface displacements. Results from 6 dogs are presented in the form of the phase velocities and attenuation of 3 types of waves. The data demonstrate incompatibility with an isotropic elastic model for the mechanical behavior of the artery. The measured damping appears to be primarily due to the viscoelastic properties of the vessel wall material.

3337. Viscoelastic wave propagation and rheologic properties of skeletal muscle - Truong X.T. - *Physiometr. Res. Lab., VA Hosp., Houston, Tex.* - *AMER.J. PHYSIOL.* 1974 226/2 (256-264)

Changes in viscoelastic properties of whole frog sartorius muscle due to stretching and active contraction were studied by means of measurements of the propagation constants of longitudinal mechanical waves of different frequencies. In resting muscle, stretching was found to increase wave velocity for all frequencies and to cause an initial rise in attenuation followed by a decline at 3 kHz and 100 Hz. Active contraction was found to increase the wave velocity but decrease the attenuation. The changes in wave velocity and attenuation with active contraction were directly related to the developed tension. The significance of the effects of stretching and active contraction is discussed in terms of the viscoelastic parameters of the three component mechanical model and in terms of the relaxation time spectrum of the generalized Maxwell model. Comparison with results from conventional stress strain studies is made.

3338. A model for the transient and steady state mechanical behavior of contracting muscle - Julian F.J., Sollins K.R. and Sollins M.R. - *Dept. Muscle Res., Boston Biomed. Res. Inst., Boston, Mass.* 02114 - *BIOPHYS.J.* 1974 14/7 (546-562)

A model was developed which can simulate both the transient and steady state mechanical behavior of contracting skeletal striated muscle. Thick filament cross bridges undergo cycles of attachment to and detachment from thin filament sites. Cross bridges can attach only while in the first of 2 stable states. Force is then generated by a transition to the second state after which detachment can occur. Cross bridges are assumed to be connected to the thin filaments by an elastic element whose extension or compression influences the rate constants for attachment,

detachment, and changes between states. The model was programmed for a digital computer and attempts made to match both the transient and the steady state responses of the model to that of real muscle in 2 basic types of experiment: force response to sudden change in length and length response to sudden reduction of load. Values for rate constants and other parameters were chosen to try to match the model's output to results from real muscles, while at the same time trying to accommodate structural and biochemical information.

3339. Compressive fatigue behaviour of bovine compact bone - Gray R.J. and Korbacher G.K. - *Inst. Aerospace Studies, Univ. Toronto* - *JBIOMECH.* 1974 7/3 (287-292)

The response of compact bone tissue to a fluctuating compressive fatigue load was examined and the S N curve relating the maximum applied compressive stress and the number of cycles to failure was established. Cylindrical specimens longitudinally from the mid diaphysis of fresh bovine femora were fatigued at maximum compressive stress levels between -11500 and -15000 psi. The corresponding median fatigue lives ranged from 4.42×10^6 cycles (-11500 psi) to 1.04×10^7 cycles (-15000 psi), and fatigue lives greater than 10^7 cycles were observed at the lowest stress level. The tissue density and the elastic modulus and failure stress in compression of the compact bone source material were also measured.

3340. Analysis of the dynamic behavior of neuron populations in the turtle cerebellum: II. Lumped circuit model - Bantli H. - *Dept. Physiol. Anat., Univ. California, Berkeley, Calif.* - *KYBERNETIK* 1974 15/4 (213-225)

A lumped circuit model was constructed which consisted of two input channels, climbing fiber and mossy fiber afferents, which described the magnitudes of synaptic transmission and which accounted for synaptic and transmission delays. The parameters and coefficients of the transfer function were chosen such that they corresponded to physiological observable quantities. The corresponding time function approximated the data points. The results indicated that the dynamic behavior of the cerebellar circuit was satisfactorily accounted for by a parallel excitatory and inhibitory system with a combined climbing fiber and mossy parallel fiber input exciting the Purkinje cells. The initial negative was predominantly a climbing fiber response of the Purkinje cell supporting the inference which was derived from purely electrophysiological data.

2.3. Heat and thermodynamics

3341. Use of a heat transfer analogy for a mathematical model of respiratory tract deposition - Yeh H.C. - *Lovelace Found. Med. Educ. Res., Albuquerque, N.M.* 87108 - *BULL.MATH.BIOL.* 1974 36/2 (105-116)

Mathematical models predicting the aerosol deposition in the respiratory tract are reviewed.

Data in the literature indicated not only that the air flow in the trachea and major bronchi may not be laminar, but also that the entrance effect of the tube or airway has not been considered. A new approach to a mathematical model of respiratory tract deposition, based on the analogy of the heat and mass transfer, is discussed.

2.4. Bioacoustics

3342. A computer program for acoustic loudness - Owen R.P. - Burroughs Corp., Pasadena, Calif. - SOUND VII. 1974 8/3 (54-55)

A concise program is described, for use at a computer time sharing terminal in computing loudness, loudness level, and speech interference level from octave band measurements. Accuracy of the results is discussed.

3343. Microwave hearing: evidence for thermoacoustic auditory stimulation by pulsed microwaves - Foster K.R. and Finch E.D. - Nav. Med. Res. Inst., Nat. Nav. Med. Cent. Bethesda, Md. 20014 - SCIENCE 1974 185/4147 (256-258)

Acoustic transients can be thermally generated in water by pulsed microwave energy. The peak pressure level of these transients, measured within the audible frequency band as a function of the microwave pulse parameters, is adequate to explain the clicks heard by people exposed to microwave radiation.

3344. Equal aversion levels for pure tones and 1/3 octave bands of noise - Molino J.A. - Inst. Basic Standards, Nat. Bur. Standards, Washington, D.C. 20234 - JACOUST.SOC.AMER. 1974 55/6 (1285-1289)

College students tapped rapidly on telegraph key to reduce the intensity of a continuous acoustic stimulus presented through earphones. Failure to respond resulted in an intensity increase of 1 dB every 4 sec. A group of 14 students responded during 10 min sessions to eight pure tones and eight 1/3 octave bands of noise at octave frequencies from 63 Hz to 8 kHz. The average SPL maintained by the subjects became stable after about 5 min. The different asymptotic levels observed from 5-10 min were taken as a measure of equal aversion levels for the stimuli. Equal aversion levels were compared with other subjective weighting contours: equal loudness level, A weighted sound level, perceived noise level, etc. They were closest to an A weighted sound level of 80-85 dB.

3345. The effects of a visual fidelity criterion on the encoding of images - Mannos J.L. and Sakrison D.J. - Lincoln Lab., MIT, Lexington, Mass. - IEEE TRANSM.INFORM.THEORY 1974 IT-20/4 (525-536)

Shannons rate distortion function provides a potentially useful lower bound against which to compare the rate versus distortion performance of practical encoding transmission systems. However, this bound is not applicable unless one can arrive at a numerically valued measure of distortion which is in reasonable correspondence with the subjective evaluation of the observer or

interpreter. The authors have attempted to investigate this choice of distortion measure for monochrome still images. This investigation considered a class of distortion measures for which it is possible to simulate the optimum (in a rate distortion sense) encoding. Such simulation was performed at a fixed rate for various measures in the class and the results compared subjectively by observers. For several choices of transmission rate and original images, one distortion measure was fairly consistently rated as yielding the most satisfactory appearing encoded images.

2.5. Biooptics

3346. Method of analysing an induced potential taking into account the decremental nature of the process (Russian) - Zhadin M.N. and Ignatyev D.A. - Inst. Biol. Phys., Acad. Sci. USSR, Pushchino - BIOFIZIKA 1974 19/1 (143-147)

A method is considered according to which the evoked potential is presented as a superposition of quenching sinusoids. Such a form of the response allowed the apparatus of the theory of automatic control to be applied to the analysis of the induced activity. An experimental test of the model suggested was carried out with an electronic computer on averaged responses of the visual and sensorimotor cortex of the rabbits brain. A single light flash served as an afferent stimulus. Both the early and the later secondary reactions were comparatively well described by the sum of 2 quenching sinusoids. The suggested method of analysis of the evoked potential proved to be more effective than the usual spectral analysis, especially when investigating short term rapidly quenching forms of evoked responses.

3347. On the theory of lateral inhibition - Haderl K.P. - Lehrst. Biomathemat., Univ. Tubingen - KYBERNETIK 1974 14/3 (161-165)

The mathematical model for the principle of lateral inhibition in the theory of optical perception leads to a system of nonlinear equations for n real variables. This system is examined in respect of solvability and definite solvability. It appears that the equation must be considered the condition for the stationary states of a suitable time dependent system. The question of the existence of solutions and stability can in some way be fully clarified in both cases. A generalization to continuous large numbers of space variables is possible.

3348. On the medial axis function for visual patterns - Moore D.J.H. and Seidl R.A. - Dept. Electr. Engin., Univ. Maryland, College Park, Md. 20742 - IEEE TRANSSYSTMAN CYBERN. 1974 smc-4/4 (396-399)

A new version of Blum's medial axial function for visual patterns is presented. This version, incorporated in the chord space analysis framework developed by the authors, has the advantage that, unlike the original version, it is defined for grey level pictures, and is a much more robust definition. Computer generated

examples are shown, and it is indicated how the technique was applied by the authors in the development of a character recognition system.

3349. Light acceptance property of an optical fiber - Pask C. and Snyder A.W. - Inst. Adv. Stud., Dept. Appl. Mathemat., Australian Nat. Univ., Canberra - *APPOPT.* 1974 18/3 (1889-1892)

A set of curves is presented and discussed for the power in dielectric rod trapped modes launched by a coherent or highly collimated beam incident obliquely on the end of the rod. The parameters used include those of importance for modeling visual photoreceptors.

2.6. Gas physics

3350. Decompression study and control using ultrasonics - Rubissow G.J. and Mackay R.S. - Boston Univ., Boston, Mass. 02215 - *AEROSPACE MED.* 1974 45/5 (473-478)

By direct ultrasonic observation on intact human and animal subjects, it was demonstrated that bubbles are involved in decompression sickness, and these may appear at the site of discomfort rather than being only central. On many dives, bubbles first appeared in the blood in fatty tissue, but on short dives bubbles were first seen in muscle tissue. Recompression bubble showers were seen. Silent bubbles were demonstrated, as was safe ascent using ultrasonically controlled decompression to limit bubble size to a threshold value. Overpressure can be measured in individual tissues by adjusting ambient pressure so that bubbles there neither decay nor grow. With 7.5 MHz ultrasound, 1 micron (μ) and larger bubbles were routinely seen. Some optical comparisons were made in transparent fish, and goldfish were found to be able to survive severe bubble formation.

2.7. Fluid flow systems

3351. Catheter model: Transfer equation making explicit use of the length and the radius of the catheter - MODELE DU CATHETER: EQUATION DE TRANSFERT FAISANT INTERVENIR EXPLICITEMENT LA LONGUEUR ET LE RAYON DU CATHETER - Cherruault Y., Brocas J., Normand J.P. and Bourdarias J.P. - *UER 48 - Analyse, Probab. Applicat. Univ., Paris - INTL.BIOMED.COMPUT.* 1973 4/4 (295-303)

A transfer function of the catheter is proposed where the length and radius of the catheter are explicitly used, as well as the aspiration flow. The method is more precise, simpler and more rapid to use in human clinical practice than the so called 'black box' method.

3352. Study of the branching of the vascular bed. First approach with the aid of the zone of influence - ETUDE DES EMBRANCHEMENTS DU LIT VASCULAIRE. PREMIERE APPROCHE A L'AIDE DE LA ZONE D'INFLUENCE - Lefort M., Stoltz J.F. and Larcen A. - Groupe Rech. Hemorheol., Cent. Reg. Transf. Sang, Hematol., CHU, Nancy - *BIORHEOLOGY* 1974 11/1 (79-86)

It was shown that a zone of influence on the arterial wall can be defined, and that this is, to a first approximation, at the circulatory boundary. On the other hand, the visualization of the flow revealed 2 immobile zones which may be the preferred sites of any eventual deposits (atheroma). The experimental method is still a long way from the real problem, and in the future it will be necessary to study an identical model with suspension, elastic ducts and even a pulse regime. Also, the effects of the angle of bifurcation should not be neglected, especially when considering the variations of the hematocrit in the derivations.

3353. A model of steady blood flow - Ware J.H., Sorrell F.Y. and Felder R.M. - Dept. Engin. Mechan., North Carolina State Univ., Raleigh, N.C. - *BIORHEOLOGY* 1974 11/2 (97-109)

A mathematical model is presented for the steady flow of blood in rigid straight circular tubes. The blood is modeled as a two layer fluid for which the constitutive equations are Newtonian for the plasma layer near the wall and after Casson for the whole blood in the core. Dimensional analysis is used to obtain an expression for the marginal layer thickness in terms of the Reynolds and Bingham numbers and the blood hematocrit. Velocity profiles calculated from the model agree well with experimental results and the calculated marginal layer thickness has a maximum deviation of 37% from experimentally determined values. The model allows the computation of pressure drop flow rate relations from reservoir parameters of the blood and the tube diameter, and also predicts shear thinning and apparent viscosity decrease with decreasing tube diameter as observed in experiments.

3354. A note on open linear systems - Hearon J.Z. - Mathemat. Res. Branch, Nat. Inst. Arthr., Metab. Dig. Dis., NIH, Bethesda, Md. - *BULL.MATH.BIOL.* 1974 36/1 (97-99)

A theorem is given which states a necessary and sufficient condition for the specific activity to be uniform throughout an open compartmental system in the steady state.

3355. An approach to closed loop control analysis of the human blood pressure system for experimental and clinical investigations - EINE MOGLICHKEIT REGELPHYSIOLOGISCHER BLUTDRUCKANALYSEN IN EXPERIMENT UND KLINIK - Zwiener U. - Pathophysiol. Abt., Nervenklin., Med. Akad., Erfurt - *ACTA BIOL.MED.GERM.* 1973 31/4 (561-568)

A device for the closed loop control analysis of the human blood pressure system is described. By an indirect pressure recording on the flattened artery surface the arterial blood pressure (A. temporalis), the mean pressure, the pulse rate and the breathing are simultaneously recorded before, during and after orthostatic inputs. The responses are mathematically defined.

3356. A simple model of the blood vessel system for the simulation of stationary blood flow. II. A model for passively distensible vessels - EIN EINFACHES GEFASSMODELL ZUR SIMULATION STATIONAREN

KREISLAUFVERHALTENS TEIL II. EIN PASSIV DEHNBARES GEFÄSSMODELL - Ranft U. - Dept. Biomet. Med. Informat., Med. Hochschule, Hannover - BIOMED/TECHN. 1974 19/3 (106-111)

Starting from a mathematical model for branched, rigid tubes as described in the previous part of this study one can now include passive distensibility of the blood vessels. One state of the vessel system is determined by the given pressure volume characteristics of the respective vessel groups, by the changes in diameter through muscle tonus of the vessel walls, by vessel closures and by hematocrit values. The following circulation system variables were simulated for 8 different cardiac performances: volume flow and total resistance as a function of total pressure drop, of partial pressure drop in the various vessel groups, and as a function of total volume. As in part I of this study laminar and nonpulsatile flow was assumed, allowing the use of Hagen Poiseuilles law. The nonlinear elastic properties of the vessel walls determine decisively the nonlinear behavior of flow resistance under different cardiac performance conditions. Since muscle tonus influences the elastic properties of a vessel significantly, the importance of vessel groups with very muscular walls (small arteries, arterioles) is clearly recognized for the regulation of the blood circulation.

3357. Motion extraction for left ventricular volume measurement - Tasto M. - Philips Forsch. Lab. Hamburg GmbH, Hamburg - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (207-213)

Methods to determine automatically the boundary of left heart chambers from X ray films (cineangiograms) by computer are discussed. Several authors have considered entering a first approximation to the boundary manually by light pen, and then letting the computer determine the exact boundary from successive frames automatically. A method to do the first step automatically as well is proposed in this paper, utilizing ventricle motion and contrast medium flow. Experiments indicate that brightness as a function of time varies much stronger inside the area of the left heart chamber than outside, due to heart contraction and contrast medium fluctuation. Hence, using a suitable criterion for motion, it is possible to extract an approximate outline of the left ventricle by simple operations. This outline is then used as initial information for the subsequent frame by frame detection of the precise boundary of the heart chamber.

3358. Dynamic model of ventilatory response to changes in pO_2 at the carotid body chemoreceptors - Smith E.J. and Dutton R.E. - Dept. Biomed. Engin., Rensselaer Polytechn. Inst., Troy, N.Y. 12181 - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (227-231)

Much of the recent work evaluating the role of the carotid body chemoreceptors in the control of ventilation has involved the application of transient stimuli. The response of ventilation to a sustained step decrease in $P(O_2)$ from 90 mm Hg to 32 mm Hg of blood perfusing the carotid bodies of dogs indicated an abrupt increase in

ventilation to nearly the final steady state levels. The similarity of this response to the classic linear second order system response prompted the investigations of a mathematical model that could be used to simulate the ventilatory control loop. It has been determined that the response of the ventilatory system of the dog to step, ramp, pulse, and pulse train inputs of hypoxia can be simulated with good accuracy by a nonlinear closed loop feedback system that contains linear second order dynamics. The input to this system is proportional to the magnitude and the rate of change of $P(O_2)$ at the carotid bodies.

3359. Theoretical analysis of the CW Doppler ultrasonic flowmeter - Brody W.R. and Meindl J.D. - Dept. Electr. Engin., Stanford Univ., Stanford, Calif. 94305 - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (183-192)

The widespread application of ultrasonic techniques for the measurement of pulsatile blood flow has been hampered by the lack of a detailed theoretical understanding of the Doppler ultrasonic flowmeter. A general model for the Doppler flowmeter based upon stochastic considerations of the scattering of ultrasound by blood is presented. The model characterizes the backscattered ultrasound as a Gaussian random process and the expression for the autocovariance function is derived. For the CW Doppler flowmeter, the power spectral density function is computed, and its significance is emphasized: measurement of the blood flow velocity corresponds to estimation of the average frequency of the Doppler power spectrum. The CW Doppler flowmeter, if properly constructed, can measure either local velocity of flow averaged over one small portion of the vessel cross section, or it can detect the average velocity of flow (and hence estimate volume blood flow) over the entire vessel lumen. In either instance, the requirements for proper operation of the CW Doppler flowmeter are: a uniform illumination of the region of the blood vessel of interest by the transducers and an estimation of the mean or average Doppler frequency (first moment) of the Doppler power spectrum. For volume flow estimation, these requirements are absolutely essential. For local velocity measurements, a narrow Doppler spectrum is produced, and conventional FM demodulators (such as the zero crossing counter) can be substituted for the average frequency detector with only a minimal degradation in system performance. When operated in the average velocity or volume flow mode, the CW Doppler flowmeter behaves similarly to the electromagnetic flowmeter in that both require uniform vessel illumination and both estimate average velocity. The Doppler system has two important advantages, however. It does not require in vivo calibration and it has a stable zero flow reference.

3360. The hydraulic skeleton of the heart. A working hypothesis to explain the chamber unfolding mechanism - DAS HYDRAULISCHE SKELETT DES HERZENS. EINE ARBEITSHYPOTHESE ZUM KAMMERENTFALTUNGSMCHANISMUS - Lunkenheimer P.P. and Ising H. - Physiol. Inst., Freie Univ., Berlin Dahlem - ZBL.VETERINARMED.REIHE A 1974 21/5

A comparison is made between the hydraulic heart skeleton and the garden hosepipe phenomenon as working hypotheses to explain unfolding heart chambers. Both hypotheses are discussed on a mathematic and physical basis in respect of their effective power to produce opening up of the chambers. The calculations are based on observations on a model ventricle. The garden hosepipe phenomenon is best suited to the most favorable physiological data, whereas the hydraulic heart skeleton hypothesis fits best the most unfavorable physiological conditions. Under these conditions the results suggest that the hydraulic contains within it some 10 times as much power as the garden hosepipe mechanism. Finally there are brief commentaries on the significance of the 2 hypotheses for the understanding of pathological changes in the heart.

3361. Propagation of pressure pulse in non Newtonian fluids. A theoretical and experimental investigation - Ravindran R. - *Aerodynam. Inst., Techn. Hochsch., Aachen* - *Biorheology* 1974 11/3 (197-205)

The propagation of waves generated by an imposed sinusoidal pressure gradient in non Newtonian fluids contained in elastic tubes is studied, theoretically and experimentally. Theoretically this system is specified by the equations of motion for a micropolar fluid and those for an elastic membrane, together with suitable boundary conditions. The experimental set up consists of a piston, which is set in harmonic motion at the start of the experiment, at one end of a fluid filled PVC tube. The fluids used are 2 and 1% CMC solutions, 70% glycerine-water solution and water. The velocity of wave propagation measured in the experiment is compared with the Moens Korteweg velocity for inviscid fluids and the corresponding velocity for purely viscous fluids derived by Morgan and Kiely. Asymmetric initial wave forms are observed experimentally and are studied theoretically with the help of the method of characteristics.

3362. A digital computer model of the renal medullary countercurrent system - Furukawa T., Takasugi S., Inoue M. et al. - *I Dept. Int. Med., Med. Sch., Osaka Univ., Osaka* - *COMPUTERS BIOMEDRES.* 1974 7/3 (213-229)

A mathematical model of the renal medulla was made, integrating structural and functional concepts into a unified understanding of the mechanisms involved. The medulla was assumed to have vasa recta, the loops of Henle, collecting tubules and interstitium. Numerical studies were carried out to simulate the movement of water, sodium and urea in nonsteady states on an assumption that sodium pump exists along the loops of Henle and collecting tubules, and that no active transport of urea exists in the kidney. The model yielded piecewise continuous curves for volume flow rate, and sodium and urea concentration profiles which reasonably agree with available data along the consecutive segments. It was shown that the osmolality gradient could not be reproduced reasonably well

without taking into account the presence of the sodium pump along the thin loops of Henle. It was also shown that the concentration gradient for urea could become steeper than that of sodium without resulting in its active transport.

2.8. Electrical systems

3363. Adaptive model of the system of receptor and horizontal cell (Russian) - Podvigin N.F. and Mitov D.L. - *I.P. Pavlov Inst. Physiol., Acad. Sci. USSR, Leningrad* - *BIOFIZIKA* 1974 19/1 (163-168)

From the data of frequency analysis of the late receptor potential of the cat an adaptive model of the system comprising receptor and horizontal cell is constructed. The experimental results obtained on the model are compared with electrophysiologic data on the receptor. Parameters of the modelled system responsible for its reconstruction during slow photochemical adaptation and causing a shift in the dynamic characteristics of the system during fast nerve adaptation are analysed. It is shown that the Weber Fechner law and the law of time summation are accomplished on the model.

3364. Markov model of learning: Length of the first run of incorrect responses, when only n trials of the process are known - Komenda S. - *Inst. Med. Phys., Med. Fac., Palacky Univ., Olomouc* - *ACTA UNIV. PALACKI. OL. OMUC. FAC. MED.* 1973 Vol.67 (307-313)

The properties of the characteristic of learning were studied, defined as the length of the first run of incorrect responses in the situation, when only the first n trials of the learning process were recorded. The formulae for the probability distributions and the mean values were derived in the case of the N_h and S_h models and a comparison was carried out with the corresponding quantities based on the non reduced record of the process. Further, the formulae for the amount of information about the parameters of the model contained in the studied characteristic were derived. The loss of information induced by the reduction of the record was determined numerically.

3365. Markov model of learning: Length of the first run of correct responses - Komenda S. - *Inst. Med. Phys., Med. Fac., Palacky Univ., Olomouc* - *ACTA UNIV. PALACKI. OL. OMUC. FAC. MED.* 1973 Vol.67 (315-328)

The properties of the characteristic of learning were studied, defined as the length of the first run of correct responses. Formulae for the probability distribution and the mean value of this characteristic were derived. Further, the formulae for the amount of information about the parameters of the model were derived, as contained in the sample space of the studied characteristic. This information was compared with the information about these parameters contained in the sample space of the original nonreduced record of learning. In this way, the possible loss or gain of information resulting from the introduction of the studied characteristic of learning could be evaluated.

3366. Markov model of learning: Length of the first run of correct responses, when only n trials of the process are known - Komenda S. and Tesarikova E. - Inst. Med. Phys., Med. Fac., Palacky Univ., Olomouc - ACTA

UNIV. PALACKY OLOMUC FAC. MED. 1973 Vol.67 (329-341)

The properties of the characteristic of learning were studied, defined as the length of the first run of correct responses provided that the process was recorded only in its first n trials. The formulae for the probability distributions and expectations were derived, as also formulae for the amount of information about the parameters of the model contained in the sample space of the studied characteristic. The corresponding numerical results made it possible to evaluate the dependence of these quantities on the size of reduction of the empirical records.

3367. Frequency sensitivity of auditory fibers in the eighth nerve of the spadefoot toad

Scaphiopus couchi - Capranica R.R. and Moffat A.J.M. - Sect. Neurobiol. Behav., Cornell Univ., Ithaca, N.Y. 14850 - JACOUSTICAL SOC. AMER. 1974 55/sup. (s85)

Spadefoot toads are primitive anurans which possess poorly developed eardrums on each side of their head for detection of airborne sound. Electrophysiological recordings from single fibers in the eighth nerve of *Scaphiopus couchi* reveal two distinct populations of auditory fibers. One type is maximally excited by low frequency tones in the range 100-700 Hz. The response of each of these units to an excitatory tone can be totally inhibited by the addition of a second tone of higher frequency. The other population of fibers has its best excitatory frequencies distributed over the range of 900-1500 Hz. These fibers cannot be inhibited by the presence of a second tone. Units in both populations possess thresholds as low as 40 dB SPL (re 0.0002 dyn/cm²), so that the primitive eardrum of these animals provides moderately sensitive detection of airborne sounds. The population of fibers tuned to the higher frequency range seem specialized for detection of the vocal signals of this species. The low frequency inhibitable units seem specialized for detection of other types of sounds. A comparison of the response properties of auditory nerve fibers in this primitive toad is contrasted with more modern anuran species.

3368. A method of statistical neurodynamics - Amari S.I. - Univ. Tokyo - KYBERNETIK 1974 14/4 (201-215)

A method of statistical neurodynamics is presented for treating ensembles of nets of randomly connected neuron like elements. The concept of a macrostate plays a fundamental role in statistical neurodynamics and a criterion is given for ascertaining that given macroscopic quantities together constitute a macrostate. The activity of a nerve net is shown to be a macrostate and the equation of the dynamics of the activity is elucidated for various ensembles of random nerve nets. It is shown that the distance between 2 microstates can also be treated as a macrostate in a generalized sense. The equation of its dynamics represents how the distance

between 2 states changes in the course of state transitions. The dynamics of distance reveals interesting microscopic properties of random nerve nets, such as the stability of state transition, the transient lengths, etc.

3369. Sequential analysis of ponto geniculo occipital (PGO) activities in the cat - ANALYSE SEQUENTIELLE DE L'ACTIVITE PGO CHEZ LE CHAT - Chouvet G. and Gadea Ciria M. - Dept. Med. Exp., Univ. Claude Bernard, Lyon - ELECTROENCEPH. CLIN. NEUROPHYSIOL. 1974 36/6 (597-607)

PGO waves were recorded from lateral geniculate nuclei of normal cats. In order to quantify the temporal organization of these waves during the episodes of paradoxical sleep (PS), a statistical analysis of the time of occurrence of PGO waves was performed. Within each episode of PS, there was no significant trend in the rate of occurrence of PGO waves. The probability density function of intervals between events had one mode at about 150 msec and a very long tail. The second order properties analysis of intervals showed that the process did not seem to be a renewal process: two kinds of events could be distinguished which corresponded roughly with isolated PGO and bursts of PGO waves. To represent with reasonable accuracy the main features of interest in such a pattern, a semi Markov model was computed.

3370. Improved neuronal models for studying neural networks - Stein R.B., Leung K.V., Mangeron D. and Oguztoreli M.N. - Dept. Physiol., Univ. Alberta, Edmonton - KYBERNETIK 1974 15/1 (1-9)

Previous neuronal models used for the study of neural networks are considered. Equations are developed for a model which includes a normalized range of firing rates with decreased sensitivity at large excitatory or large inhibitory input levels, a single rate constant for the increase in firing rate following step changes in the input, and one or more rate constants, as required to fit experimental data for the adaptation of firing rates to maintained inputs. Computed responses compare well with the types of neuronal responses observed experimentally. Depending on the parameters, overdamped increases and decreases, damped oscillatory or maintained oscillatory changes in firing rate are observed to step changes in the input. The integrodifferential equations describing the neuronal models can be represented by a set of first order differential equations. Steady state solutions for these equations can be obtained for constant inputs, as well as the stability of the solutions to small perturbations. The linear frequency response function is derived for sufficiently small time varying inputs. The linear responses are also compared with the computed solutions for larger non linear responses.

3371. Experimental analysis of a neural system: two modeling approaches - Marmarelis P.Z. and Naka K.I. - Informat. Sci., California Inst. Technol., Pasadena, Calif. - KYBERNETIK 1974 15/1 (11-26)

The retinal neural system in the catfish which transforms light intensity temporal

variations into the horizontal cell potential is experimentally analyzed and modeled by two distinct methods. The first method involves testing the system with gaussian white noise modulated light intensity and the subsequent derivation of a mathematical model in terms of a Wiener functional series. The second method involves testing of the system by step and sinewave stimuli and the postulation of a set of nonlinear differential equations which are designed to fit these stimulus response data. In this latter approach, the differential equations describe the usually assumed dynamic behavior of the component subsystems, such as photoreceptor and horizontal cell membranes, in terms of properties of membrane resistance and capacitance. The system behavior is found to exhibit certain small signal nonlinearities such as dynamic asymmetry in the response as well as certain large signal nonlinearities. The two modeling approaches and the resulting models are compared and it is found that the functional model derived from the white noise experiment, while it does not attempt to describe the underlying system structure as the differential equation does, produced, in general, more satisfactory results as far as the input output behavior of the system is concerned. It is suggested that combination of the two approaches could be very fruitful in modeling a particular system.

3372. Model of brain rhythmic activity. The alpha rhythm of the thalamus - Lopes Da Silva F.H., Hoeks A., Smits H. and Zetterberg L.H. - Brain Res. Dept., Inst. Med. Phys., Nat. Hlth Res. Council, TNO, Utrecht - *KYBERNETIK* 1974 15/1 (27-37)

A model of a neuronal network was set up in a digital computer based on histological and biophysical data experimentally obtained from the thalamus; the model included 2 populations of neurons interconnected by means of negative feedback; in the model allowance was also made for other sort of interactions. To test the hypothesis that the alpha rhythm (8-13 Hz rhythmic activity characteristic of the EEG) is a filtered noise signal the simulated neuronal network was stimulated by random trains of pulses with a Poisson distribution. The density of pulses fired by the simulated neurons was computed as well as the oscillations of the mean membrane potential of the population of simulated neurons. The latter was found to be equivalent to the experimentally obtained alpha rhythms. In order to test the hypothesis that several noise sources are responsible for thalamo cortical coherences 3 simulated neuronal networks were coupled together using several noise sources as secondary inputs. It was shown that although all the networks produced simulated alpha signals with identical spectra they could have significantly different values of coherence depending on the relation between correlated and uncorrelated input signals. The model was analyzed by means of linear systems analysis after introducing the necessary simplifications and approximations. In this way it was possible to evaluate the influence of different physiological or histological parameters upon the statistical

properties of the resulting rhythmic activity in an analytical form. By changing the model parameters it was shown that a family of spectral curves could be obtained which simulated the development of the EEG as function of age from a predominantly low frequency to a clearly rhythmic type of signal. This was shown to depend mainly on the feedback coupling parameters.

3373. The current to frequency conversion of extraocular motoneurons - Daley M.L. and Barmack N.H. - Lab. Neurophysiol., Good Samaritan Hosp. Med. Cent., Portland, Ore. 97210 - *KYBERNETIK* 1974 15/1 (39-45)

A description of the current to frequency conversion of extraocular neurons is presented. The discharge frequency of extraocular motoneurons of the cat to intracellular stimulation is rate sensitive to both depolarizing and hyperpolarizing current waveforms. From a time domain analysis of the relationship between the stimulus input current and the mathematically described measured neuronal discharge rate, the system impulse response is obtained by deconvolution. The description includes 2 nonlinearities, a threshold element and a current saturation element. The output of the derived process description is compared to experimental observations, evoked by a variety of current waveforms. The rate sensitive behavior of extraocular motoneurons is demonstrated by a graph of gain versus the modulation frequency of stimulus current. It is suggested that the high frequency gain characteristic of the system partially compensates for the low pass transfer property of the extraocular muscles and orbital tissues. Thus the adaptive characteristics of these neurons could generate the neural signal necessary for the occurrence of saccadic eye movements.

3374. Electrical response to vibration of a lipid bilayer membrane - Ochs A.L. and Burton R.M. - Committee Molec. Biol., Washington Univ., St. Louis, Mo. 63130 - *BIOPHYS.J.* 1974 14/6 (473-489)

The discovery and characterization of a vibration response in a black lipid bilayer membrane is the topic of this paper. An electrical vibration response is obtained when the membrane is under voltage clamp and a weaker, but significant, response is obtained under current clamp. The effect arises from an induced variation in the membrane capacitance. It is further shown that the capacitance variation arises from a change in the membrane area as the membrane undergoes drumhead vibration. Possible physiological significance in mechanoreception is discussed.

3375. Multivariate vectorial analysis of the visual evoked response - Van Hoek L.D. - Dept. Ophthalmol., State Univ., Utrecht - *KYBERNETIK* 1974 15/2 (65-72)

Principal component analysis of a set of visual evoked responses yielded vectorial representations of the responses in a diagram of a reduced dimensionality. In a vectorial diagram the responses can be resolved into components, associated with the aspects of the stimulus

modulation and the state of the visual system. The appearance of a scotopic and a photopic component is demonstrated. In another experiment small modulations of luminance and color evoked the responses. The distorting effect of a type of non linearity of the visual system, i.e. latency variation of the responses and the components, is discussed and demonstrated.

3376. Mathematical model of the generation of impulses by a neurone of the tonic type -

Pokrovskii A.N. - Inst. Physiol., Siberian Div., USSR Acad. Scis, Novosibirsk - BIOPHYSICS (Oxford) 1973 18/4 (747-754)

The intensity of the non steady random flux of spikes of the neurone is calculated. The flux of the spikes is regarded as an inhomogeneous process of restoration. In order to calculate the intensity, the non steady variant of the Palm formula is used. The working formulae are derived and examples for 2 variants of the model calculated.

3377. Frequency wavenumber spectrum analysis of EEG multielectrode array data -

Pinson L.J. and Childers D.G. - Dept. Electr. Engin., Auburn Univ., Auburn, Ala. 36830 - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (192-206)

Electroencephalographic (EEG) data consisting of visual evoked responses monitored via an array of electrodes from humans and penicillin induced focal epileptic discharge data recorded from rat neocortex are analyzed. This procedure, previously applied to seismic array data, offers a method by which the high resolution vector velocity and, thus, the direction and speed of propagating wavefronts can be estimated.

3378. Standardization and interpretation of the electromechanical properties of bone -

Gundjian A.A. and Chen H.L. - Dept. Electr. Engin., McGill Univ., Montreal - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (177-182)

The development of a method is reported that allows the quantitative determination of the anisotropic electromechanical properties of bone as a function of the actual specific crystalline quality of the sample under consideration. In order to provide means of standardization and interpretation of the variation of such properties, all measured values of the latter, from a given sample, are transformed into those corresponding to a reference standard sample with a well defined idealized crystalline structure. The application of this method to the stiffness tensor, piezoelectric tensor, and dielectric tensor components is specifically treated in this paper.

3379. Design of a fast voltage clamp for biological membranes, using discontinuous feedback -

Brennecke R. and Lindemann B. - Abt. Membranforsch. Epithelien, II Dept. Physiol., Homburg - REV.SCLINSTRUM. 1974 45/5 (656-661)

The construction of a voltage clamp with discontinuous feedback is described. Its main feature is a pulsed membrane current with an amplitude proportional to the voltage error, which is determined by integration in the pulse intervals. A current pulse of 8 μ sec length

repeating every 24 μ sec is used. Gain switching assures a fast response to large errors, as well as high steady state accuracy. Membrane voltage changes by 150 mV in 8 μ sec to 1% of the final value. 50 μ sec after such a step, a change of resistive membrane current can be read reliably. Performance is demonstrated with equivalent networks of biological membranes and with applications to black lipid membranes and epithelial membranes.

3380. A general relation between membrane potential, ion activities, and pump fluxes for symmetric cells in a steady state -

Jacquez J.A. and Schultz S.G. - Dept. Physiol., Univ. Michigan Med. Sch., Ann Arbor, Mich. 48104 - MATLBIOSCI. 1974 20/1-2 (19-25)

For steady states of cells that have uniform cell membranes, there must be zero net fluxes of each ion. This provides a set of conditions more restrictive than the condition of zero net current flow that is used to derive the Goldman equation, leading to a set of general relations between the membrane potential, ion activities, ion permeabilities, and pump fluxes, the Goldman equation being but one of this set. Further, it is demonstrated that the transmembrane potential is uniquely defined by the intracellular and extracellular activities, the permeability coefficients, and the ratio of the net mediated (nondiffusional) fluxes of any two ions of the same valence in a steady state, regardless of the behavior of other ions and without assumptions with respect to the electrical potential profile across the membrane. In the course of this, an exact and general derivation of the Mullins Noda relation is given.

3381. Electrotonus on a nonlinear dendrite -

Pickard W.F. - Dept. Electrical Engin., Washington Univ., Saint Louis, Mo. 63130 - MATLBIOSCI. 1974 20/1-2 (75-84)

The problem of electrotonus along an infinite cylindrical dendrite is reexamined by assuming that the several passive ionic fluxes across the dendrite's plasmalemma are given not by Ohm's law but by the constant field equation. The electrotonic behavior of the dendrite modeled in this way is significantly nonlinear: in particular, the electrotonic propagations of inhibitory and excitatory postsynaptic potentials became quantitatively different. The probable implications for neural data processing are discussed, and it is suggested that this nonlinearity will render an already difficult problem yet more difficult.

3382. Irradiance dependency of the phytochrome system in cotyledons of mustard (Sinapis alba L.) -

Schaefer E. and Mohr H. - Biol. Inst. II, Univ. Freiburg i. Br. - J.MATH.BIOL. 1974 1/1 (9-15)

The irradiance dependence of the phytochrome system in the cotyledons of the mustard seedling has been analyzed, using the steady state level of total phytochrome (P(tot)) under continuous far red light as a parameter. The steady state level was found to be proportional to the reciprocal of the irradiance of the far red light. This is in quantitative agreement with a theoretical prediction which is

derived from the model of the phytochrome system.

3383. Patterns of phase compromise in biological cycles - Winfree A.T. - Dept. Biol. Sci., Purdue Univ., West Lafayette, Ind. 47907 - J.MATH.BIOL. 1974 1/1 (73-95)

It often happens that scalar valued observables of biological interest are points not on the real line, but on the circle... for example phases of periodic events, and colors. Sometimes one such quantity depends upon two others in a symmetric way, for example, in determining a compromise phase after slime mold plasmodia are fused at different phases of the cell cycle, or in determining the color of a mixture of two colors. In such cases the experimental result cannot depend on the two inputs in an unreservedly continuous way: there must be a point of ambiguity or discontinuity. Experiments involving the cell cycle and glycolysis are examined, in which the discontinuity appears to take two different forms.

3384. A modification of the French and Stein neural analog - Thexton A.J. - Dept. Physiol., Med. Coll., St. Bartholomew's Hosp., London - IEEE TRANSDUCERS 1974 bme-21/4 (339-341)

The way in which accommodation is modeled in the French and Stein (1970) electronic neural analog may cause it to behave differently from a real neuron during an inhibitory potential. This was overcome by incorporating half wave rectification into that part of the circuit modeling accommodation.

3385. Analysis of the dynamic behavior of neuron populations in the turtle cerebellum: I. General topological model - Bantli H. - Dept. Physiol. Anat., Univ. California, Berkeley, Calif. - KYBERNETIK 1974 15/4 (203-212)

Linear differential equations were used to describe the cerebellar neuron population dynamics corresponding to the conditions observed following electrical stimulations. Only known histological and electrophysiological constraints were imposed during the derivation of the model. The results indicated that a parallel excitatory and inhibitory feed forward system was responsible for the Purkinje cell output. The difference in the input transference to interneurons and Purkinje cells implied different input characteristics to both neuron populations. The predicted dead time for the feed forward inhibition was only 1.2 msec because of its gradual onset.

2.9. Nuclear biophysics

3386. Myocardial imaging using ^{13}K and the gamma camera - Martin N.D., Zaret B.L., Strauss H.W. et al. - Dept. Med., Sect. Nucl. Med., David Grant US Air Force Med. Cent., Travis AFB, Calif. 94535 - RADIOLOGY 1974 112/2 (446-448)

Although myocardial imaging with ^{13}K and the rectilinear scanner has been shown to evaluate regional myocardial perfusion reliably, attempts to duplicate these results using a

gamma camera have not been satisfactory, primarily due to collimator penetration by higher energy gamma rays. Satisfactory images were obtained when the pinhole collimator was fitted with a small insert and additional lead shielding was placed between the collimator and the patient.

3. GENERAL INSTRUMENTATION

3387. Microfilm in medicine - MIKROFILM IN DER MEDIZIN. EIN ERFAHRUNGSBERICHT - Sollorz S. - Abt. Audio Visuellen Dokumentat. Mikrofilm, Klin. Steglitz, Freie Univ., Berlin - MED.MARKT ACTA MED.-TECHN. (Berl) 1974 22/3 (69-70)

For filming patient records in the Steglitz clinic (Free University, Berlin) the unperforated 16 mm microfilm is used. In case of normal documents it is an AHU film. In case of so called infinite forms, such as EEG, ECG, as well as ENG and EMG a fine grained film is used. Both kinds of films are 30.5 m. The unperforated 35 mm microfilm, by means of which the radiologic documents from urology and radiodiagnostics are microfilmed, is also 30.5 m. The LogEtronics microfilm system was tested. The present operating procedure guarantees a filming of about 2400 pieces of radiographs per day.

3388. An inexpensive additive tricolor mixer capable of continuous variations in hue and saturation - Geddies J.C. - Dept. Psychol., Baylor Univ., Waco, Tex. 76706 - PSYCHOPHYSIOLOGY 1974 11/3 (388-390)

A design is presented for the construction of an inexpensive tricolor mixer which is capable of continuous variation in hue and saturation. The degree of precision of measurement of the stimuli produced can be manipulated to meet the demands of the experimenter by selection of filters and mechanical components.

3389. Radio frequency interference - Shoup D. - INSTRUMENTS CONTROL SYST. 1974 47/7 (63-66)

Radio frequency interference (RFI) is one of the most misunderstood and underestimated problems in building reliable automated measurement and control systems. Often its apparent randomness will make RFI extremely difficult to pinpoint as the source of trouble.

3390. Qualifications of instruments: an overview - Vellender G.C. - Pioneer Serv. Engin. Co., Chicago, Ill. - ISA TRANS. 1974 13/1 (7-13)

Critical instrumentation, used in nuclear power generating stations to ensure public health and safety, requires qualification to assure its operation under extremes of environmental and seismic conditions. This paper provides a synopsis of these requirements, indicates problems and outlines the activities of the technical societies in developing standards.

3391. Intrinsically safe systems: what's different for the maintenance man? - Magison E.C. - Honeywell Inc., Fort Washington, Pa. - ISA TRANS. 1974 13/1 (46-49)

The Intrinsically Safe System which is in

common use to make instrument installations safe, is discussed from more practical points of view, i.e., the techniques connected with installation and maintenance of the system. It is shown that safe systems are built and maintained as long as safety is kept in mind during the design of the hardware, construction, and wiring of the installation.

3.1. Transducers

3392. Adapting small dc motors for precise speed control - Wilcox S.D., Eide S.A. and Caldwell D.R. - Sch. Oceanography, Oregon State Univ., Corvallis, Ore. 97331 - REV.SCLINSTRUM. 1974 45/4 (510-512)

Utilizing a light reflective transducer as sensor and an integrated circuit phase comparator for error detection, the rotation rate of an ordinary permanent magnet dc motor can be controlled throughout wide ranges of both speed and load with the same precision as can the frequency of an oscillator. Both motor adaptations and circuitry are simple and relatively inexpensive.

3393. Simple device for photomultiplier cooling - Benci S., Benedetti P.A. and Manfredi M. - Lab. Stuario Proprieta Fis. Biomolec. Cell., CNR, Pisa - APPLIED. 1974 13/7 (1554-1555)

A class of photomultiplier coolers is based on the circulation of low temperature dry gas. The drawback common to these appliances is the use of sealed envelopes containing the photomultiplier held at low temperature including the divider often potted together with the photomultiplier itself. The authors constructed a circulation cooler capable of reaching -165°C in which cited limitations are avoided.

3.2. Amplifiers

3394. Calculation of high pass and low pass filters with Tschebyscheff characteristics. I - BERECHNUNG AKTIVER HOCH UND TIEFPASSFILTER MIT TSCHEBYSCHEFFCHARAKTERISTIK. I. TEIL - Editorial - ELEKTRONIK 1974 23/1 (33-34)

Instructions are given which enable even the nonspecialist to construct high pass and low pass filters of 2nd to 10th order, with the use of tables. For the calculation of low pass filters a method is indicated allowing the use of current capacity values.

3395. Three terminal shielded resistors for fast electrometers - Kendall B.R.F. and Reiter R.F. - Dept. Phys., Pennsylvania State Univ., University Park, Pa. 16802 - REV.SCLINSTRUM. 1974 45/6 (850-852)

The design of electrometer feedback resistors for use at frequencies up to the kilohertz range is discussed. It is shown experimentally that the addition of capacitive coupling between the electrometer output and the center of the feedback resistor, combined with suitable shielding, gives substantially better performance at high frequencies than is

obtainable with more conventional designs.

3396. Logarithmic amplifier accepts 100 dB signal range - Jeremiasen R. - HEWLETT PACKARD 1974 25/7 (16-17)

Swept frequency tests of filter response, for example the signal level may change rather abruptly. To accommodate a wide amplitude range when making plots of frequency response, the detector often works with a logarithmic amplifier. The amplitude range that can be accommodated by such an arrangement has commonly been 40-60dB, with 80dB being something of a special achievement. But now, with the growing sophistication of hybrid thin film and monolithic integrated circuit technologies, it is possible to design a logarithmic amplifier with an input range of over 100 dB, and build it at modest cost.

3.3. Indicators

3397. Computer controlled synthesis of tomograms by means of a TV storage tube - Hoefer E.E., Grimmert H. and Kieslich B. - Philips Forsch. Lab. Hamburg GmbH, Hamburg - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (243-244)

An improved electronic system for synthesizing tomograms is described. All functions are controlled by a minicomputer. The addition of TV images is performed by a video storage tube. Resolution values of the individual components as well as of the total system are given.

3.4. Recorders

3398. Long term free ranging recording using data integral to pulse frequency signal transformation - Beeler Jr G.W. and Bleil B.T. - Mayo Clin., Rochester, Minn. 55901 - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (245-246)

A method has been devised for recording low frequency DC physiologic signals for extended periods. The signal is transformed to a pulse train that can be recorded on a portable ECG tape recorder. The reproducing circuit permits the construction of an analog signal proportional to the average of the original signal.

3399. Compensation for limited dynamic range of recording instruments by use of an electronic compressor - Takeuchi K. - Dept. Aerospace Engin., Pennsylvania State Univ., University Park, Pa. 16802 - REV.SCLINSTRUM. 1974 45/6 (814-818)

Due to the limited dynamic range of magnetic tape recorders, the recording of signals with large peak excursions compared to the average energy requires a choice between over driving the recorder, or accepting a low signal to noise ratio. It is demonstrated that a simple and inexpensive limiter circuit can be successfully used to circumvent this problem. Pseudodata produced in the laboratory were recorded via such a circuit and the performance of the system was evaluated by comparing the calculated probability densities, third and fourth order

moments and spectra, of the original and recorded signals.

3.5. Generators

3400. Implanted silver silver chloride magnesium power sources - Cassel J., Satinsky V.P., Eibling D. et al. - Hahnemann Med. Coll. Hosp., Philadelphia, Pa. 19102 - MED-INSTRUMENT 1973 7/3 (176-179)

The feasibility of using biogalvanic energy to operate pacemakers and other implanted medical devices has been studied extensively. Recent techniques have demonstrated the many advantages of a silver silver chloride magnesium cell that yields in vivo 1.50 to 1.55 v at a 100 μ A current flow level and can supply as much as 1.36 v at a 1,360 μ A current flow. After modification of these electrodes, tissue reaction, as demonstrated by histological section after implantation in dogs, has been minimal during 6 mth trial periods. The silver silver chloride magnesium cell was designed so that erosion of the silver silver chloride is 90% efficient and the magnesium 60% efficient when compared to calculations from Faradays Law. Thus, 8.5 cm² of silver silver chloride and approximately 7 cm² of magnesium would furnish 1.50 v at 100 μ A for 10 yr. The properly constructed silver silver chloride magnesium cell can supply energy levels higher than any other biogalvanic cell previously investigated and has a life expectancy that makes its use feasible.

3401. Simple function generator for self construction - EIN EINFACHER FUNKTIONSGENERATOR ZUM SELBSTBAU - Gies J. - ELEKTRONIK 1973 22/5 (182-184)

A description of a function generator limited to sine, square wave, sawtooth and triangle functions is given. The circuit is considerably simpler than in the case of other function generators and the price is lower. The instrument is based on the low priced monolithic IC type ICL 8038 (Intersil).

3402. A solid state signal multiplexer - Bank H. - Dept. Anat., Duke Univ. Med. Cent., Durham, N.C. 27710 - CRYOBIOLOGY 1974 11/1 (23-27)

A solid state device has been designed which is capable of scanning up to eight thermocouple inputs and feeding the output of each sequentially into a single channel recorder. Alternately, up to four thermocouples can be amplified and multiplexed with other analog signals to provide outputs compatible with a single span range. During normal operation this unit cycles repeatedly through a present number of channels and activates the recorder pen lift mechanism between channels.

3403. A logarithmic time base generator or counter - Trump W.N. and Fowler L. - Monsanto Co., St Louis, Mo. 63166 - REV.SCLINSTRUM. 1974 45/5 (714-716)

A number of output pulses linearly related to the logarithm of elapsed time or of input pulse count is generated by a circuit including

two counters and a comparator. A fraction $1/a$ of the input pulses is applied to a continuous counter. A second cycling counter receives all input pulses above a selected starting count, counts to equality with the continuous counter, and resets with production of an output pulse. Repetition of the cycle yields an output pulse series according to the equation $t(i)/t_1 = [a/(a-1)] \exp i$, where t represents time or pulse count depending upon the source of pulses, periodic or aperiodic, and i is the number of output pulses. Conformance to the logarithmic relation $\log [t(i)/t_1] = i \log [a/(a-1)]$ is within 0.01%-0.1% for reasonably large input counts. This circuit was applied to generation of a logarithmic time base for direct linear plotting of data from thermal conductivity measurements of liquids by the transient hot wire method.

3404. Synthesis of low frequency noise for use in biological experiments - French A.S. - Dept. Physiol., Univ. Alberta, Edmonton - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (251-252)

A simple technique is described for the generation of white noise with sufficient power below 10 Hz to be useful in biological experiments.

3405. Inexpensive electrophysiologic calibration unit - Duffin Jr E.G., Solberg L.E., Hamilton W.G. and Singer D.H. - Dept. Med., Northwest. Univ. Med. Sch., Chicago, Ill. 60611 - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (249-251)

An inexpensive compact calibration circuit providing linear ramps and DC levels suitable for calibration of microelectrode recordings is described.

3406. Spectra of digital phase modulation by matrix methods - Prabhu V.K. and Rowe H.E. - Bell Lab., Murray Hill, N.J. - BELL SYSTTECHN.J. 1974 53/5 (899-935)

The spectral density of a sinusoidal carrier phase modulated by a random baseband pulse train in which the signaling pulse duration is finite and the signaling pulses may have different shapes was derived. The spectral density is expressed as a compact Hermitian form in which the Hermitian matrix is a function of only the symbol probability distribution, and the associated column vector is a function of only the signal pulse shapes. If the baseband pulse duration is longer than one signaling interval, it is assumed that the symbols transmitted during different time slots are statistically independent. The applicability of the method to compute the spectral density is illustrated by examples of binary, quaternary, octonary, and 16 ary PSK systems with different pulse overlap. Similar methods yield the spectral density of the output of a nonlinear device whose input is a random baseband pulse train with overlapping pulses.

3407. Analysis of an RF proximity switch of the two terminal type - ANALYSE EINES IIF ANNAHERUNGSSCHALTERS VOM ZWEIPOLTYP - Uemura M. - Entwickl. Labor, Omron Tateisi Electronics Co., Kyoto - INTELEKTRONRUNDSCH. 1974 28/5 (95-99)

The author deals with an RF proximity switch, whose oscillator coil is changed in its

impedance in such a manner upon the approach of conducting materials that the oscillations break off. The oscillator is operating in the critical range. A two terminal analysis is carried out in which the oscillating circuit is considered as a bipolar arrangement which forms the load circuit across the terminals of a sensor coil. The remaining circuit represents the active circuit. The frequency spectral lines of the admittances of load and active circuits are examined.

3408. Norton quad amplifier can be a low cost function generator - Vlcek P. - Orbit Contr. Ltd., Cheltenham, Gloucester - *ELECTRONICS* 1974 47/10 (98)

A versatile function generator that minimizes hardware as well as cost can be built with one of the newly introduced Norton quad amplifiers. A square wave triangular wave generator is described. With a Norton amplifier as sine shapes, a simple sine wave generator can be made. (Alijn - Nijmegen)

3409. Controlled current source is versatile and precise - Graeme J. - Burr Brown Res. Corp., Tucson, Ariz. - *ELECTRONICS* 1974 47/10 (96-97)

A precision voltage controlled current source can be made by placing a pair of complementary field effect transistors in the feedback loop of an operational amplifier. The resulting circuit has a differential input as well as a bipolar output current that can be used to drive either grounded or floating loads. From signals of up to ± 10 volts, the circuit develops a ± 10 milliamperes output, accurate to within $\pm 0.01\%$.

3.6. Telemetric devices

3410. Optical image intensification with a neodymiumized glass fibre bundle - OPTISCHE BILDAUFSTÄRKUNG MIT EINEM NEODYM DOTIERTEN GLASFASERBÜNDEL - Aberle C., Friedl W., Karning H. and Kruger H. - Zent. Inst., Eltro GmbH, Langenzell - *OPTICA ACTA* 1974 21/3 (191-209)

The image of a slide was optically intensified with an optically pumped, neodymiumized glass fibre bundle. The slide was irradiated with a neodymium YAG laser and its image at the inlet of the fiber bundle brought into the optical intensifier, the Q switch of the laser synchronized via a Pockels cell with maximum reversal of filling in the glass and the intensified image photographed through a synchronously scanned image transformer. The intensification is demonstrated by two photograms; to take the first photogram intensifier and laser were simultaneously operated and for the second they were operated in succession.

3411. A four channel ultrasonic telemetry system for obtaining physiological data from ocean divers - Fell R.B., Skutt H.R. and Waterfield A. - Virginia Polytechn. Inst., Blacksburg, Va. - *BIOTELEMETRY* 1974 1/1 (50-59)

A four channel ultrasonic telemetry system has been developed and used to obtain heart rate, body temperature, skin temperature and

water depth from scuba divers working in the ocean at depths to 30 m over a range of several hundred meters.

3412. Continuous monitoring of cardiac output - Mackay R.S. and Hechtman H.B. - Dept. Surg., Boston Univ., Boston, Mass. - *BIOTELEMETRY* 1974 1/1 (21-30)

Placing an ultrasonic probe on the chest allows measurement of flow in the aorta and its diameter, thus allowing continuous measurement of cardiac output on a beat to beat basis (stroke volume). Probe orientation is not critical, allowing telemetry. Changes in flow are more accurately measured than flow, perhaps requiring a supplementary dilution observation for certain purposes.

3413. Telemetered renal responses to avoidance and aggression in dogs - Rader R.D., Stevens C.M., Meehan J.P. and Henry J.P. - Dept. Physiol., Univ. South. California Sch. Med., Los Angeles, Calif. - *BIOTELEMETRY* 1974 1/1 (3-11)

Renal hemodynamics were investigated in unrestrained dogs by using a totally implanted telemetry system. A pulsed ultrasonic flow velocity measurement technique was specially designed to achieve power economy, a stable sensitivity factor, and a stable zero flow baseline. It detects renal artery flow while the abdominal aortic pressure is measured by an implanted button type transducer. The recorded wave shapes were analyzed in accordance with principles evolved from a hydraulic model of the kidney circulation. This model leads to estimates of the level of constriction in preglomerular and postglomerular renal vessels. In a program to study changes in these renal parameters, dogs were exposed to acute and chronic sympathetic arousal.

3414. Telemetered renal responses to avoidance and aggression in dogs - Rader R.D., Stevens C.M., Meehan J.P. and Henry J.P. - Dept. Physiol., Univ. South. California, Sch. Med., Los Angeles, Calif. 90007 - *BIOTELEMETRY* 1974 1/1 (3-11)

Renal hemodynamics were investigated in unrestrained dogs by using a totally implanted telemetry system. A pulsed ultrasonic flow velocity measurement technique has been specially designed to achieve power economy, a stable sensitivity factor, and a stable zero flow baseline. It detects renal artery flow while the abdominal aortic pressure is measured by an implanted button type transducer. The recorded wave shapes were analyzed in accordance with principles evolved from a hydraulic model of the kidney circulation. This model leads to estimates of the level of constriction in preglomerular and postglomerular renal vessels. In a program to study changes in these renal parameters, dogs were exposed to acute and chronic sympathetic arousal.

3415. The rubber band goniometry. A telemetric method for the measurement of angle, angular velocity, displacement and velocity - Neukomm P.A. - Lab. Biomech., Swiss Fed. Inst. Technol., Zurich - *BIOTELEMETRY* 1974 1/1 (12-20)

One of the important problems in

biomechanical research is the accurate measurement of displacement and velocity of the sportsmens performance without any restriction in freedom of movement of the body part to be tested. With the new rubber band goniometry technique one to three dimensional displacement was measured by means of rubber bands attached to the subject and the angle transducer. The angle, angular velocity, displacement, and also the velocity were processed and displayed by electronic equipment. This method has an accuracy of 2 to 5% and a frequency response of DC to approximately 100 Hz and can be used in sports research, in orthopedics and in many other investigations of movement. The testing method and its application to the field of biomechanics is described in detail.

3416. Power sources for implanted telemetry systems - Fryer T.B. - NASA Ames Res. Cent., Moffett Field, Calif. 94035 - *BIOTELEMETRY* 1974 1/1 (31-40)

Telemetry systems, both extracorporeal and implanted, are being used extensively to obtain physiological parameters on a chronic basis. Although extracorporeal systems can often make use of standard transducers and telemetry transmitters, implanted systems, by their unique nature, usually require special designs. Most importantly the batteries that can be changed frequently in external systems are not accessible for changing after surgical implantation. The selection of a suitable power source is a crucial consideration in the design of any implant system. The use of primary batteries, rechargeable batteries, radioactive power sources, fuel cells, inductively and RF coupled power, and mechanical energy converters are reported. Their merits and suitability for various implant applications are discussed.

3417. Fundamental design procedures of an inductance coil utilizing thin film IC technique for biotelemetry - Matsumoto G. - Dept. Biotelemetry, Res. Inst. Appl. Electr., Hokkaido Univ., Sapporo - *BIOTELEMETRY* 1974 1/1 (41-49)

The application of a cylindrical substrate as a component in a biotelemetry system is proposed, and the experimental and theoretical results concerning the deposition of thin metal films on the inner surface of the substrate are presented. The thickness distribution (peripheral and axial) of the films on the substrate was measured, and films of uniform thickness were obtained by means of the rotation of cylindrical substrate during the deposition and by the utilization of multiple line sources through the cylinder. An example for inductance is also presented and estimations for biomedical application are discussed.

3418. A four channel ultrasonic telemetry system for obtaining physiological data from ocean divers - Fell R.B., Skutt H.R. and Waterfield A. - Virginia Polytechn. Inst., Blacksburg, Va. 24061 - *BIOTELEMETRY* 1974 1/1 (50-59)

A 4 channel ultrasonic telemetry system has been developed and used to obtain heart rate, body temperature, skin temperature and water depth from scuba divers working in the ocean at

depths to 30 m over a range of several hundred meters.

3419. Recent advances in biotelemetry and their applications to measurements of pressure and electrical changes in the oviduct in vivo - Mackay R.S. - Dept. Surg., Boston Univ., Boston, Mass. - *BIOTELEMETRY* 1974 1/1 (60-64)

Transmitters have been used to study with minimum disturbance fish, porpoises and alligators freely swimming in ocean or fresh water, animals in burrows in the ground, fetuses in the uterus of conscious active mothers, monkeys in trees. Biomedical telemetry developments are briefly summarized. As an example of these considerations, the applicability of the methods to fertility studies involving observation of transport along the oviduct is indicated. The importance of alternative methods such as ultrasonics is emphasized.

3420. A complete EEG radio telemetry equipment - Geier S., Bancaud J., Talairach J. and Enjelvin M. - Serv. Neurochir. Font., INSERM U97, Hop. Ste Anne, Paris - *ELECTROENCEPHALIC J. NEUROPHYSIOL.* 1974 37/1 (89-92)

Equipment for telemetric recording of human EEGs is described. It allows the use of up to 16 channels for recording scalp EEG and/or deep activities. Each of the 16 channels consists of an input stage serving both as amplifier and impedance converter, a transmitter stage which is separated from the preceding one and a remote receiver. The overall characteristics of the complete system, from amplifier input to receiver output are as follows: input impedance $2 \times 2.5 \text{ M}$, 1000 pF; dynamic input 2 to 1000 μV ; noise level $< 5 \text{ } \mu\text{V}$ (r.m.s.); pass band 0.5 to 800 c/sec; cross talk $< 2 \text{ } \mu\text{V}$; sensitivity 5 μV ; time constant 2 sec; common mode rejection factor 50 dB; transmission distance 1000 m in free space. The total weight of the 16 channel transmitter device is 1600 g, divided as follows: miniature box with input stages and electrode connectors, 160 g placed on the patients head; 4 transmitters, 150 g each (1 transmitter for 4 channels) 1 placed on each side of the chest, 2 ventral and 2 dorsal; 4 batteries, 200 g each, in a belt.

3421. Effect of scattering by rain on radiometer measurements at millimetre wavelengths - Zavody A.M. - Appleton Lab., Slough, Bucks - *PROC.IEE* 1974 121/4 (257-263)

Scattering by rain is often neglected when evaluations of attenuation are made from aerial noise temperatures observed by radiometers. Calculations show that values may be significantly low if the attenuation is assumed to be due only to absorption in the rain. Curves are given for estimating errors at frequencies of 37, 72 and 110 GHz.

3422. Radio tracking the Rocky Mountain goat in western Montana - Rideout C.B. - Museum Nat. Hist., Univ. Kansas, Lawrence, Kans. 66045 - *BIOMED.SCLINSTRUMENT* 1974 Vol.10 (139-144)

From 1971 to 1973, 28 Rocky Mountain goats (*Oreamnos americanus*) were captured on a natural salt lick in the Sapphire Mountains of Montana. Sixteen goats were equipped with

collars containing beacon transmitters which broadcast on fixed frequencies from 27.570 to 27.680 MHz. The average transmitter life for 14 collars was 144 days. Maximum ranges of the radio collars with loop, hand held Yagi, and mast mounted Yagi antennas were 3, 5, and 9 km respectively. Percent activity was determined hourly from signals received at one antenna on a mountain top at 2640 m; goats were located by triangulation twice a day from this antenna and from another on a peak one km to the south. Activity patterns were determined from July through November. Activity peaks occur at dawn and just before sunset, although some activity occurred at all times of the day and night. Goats migrated several kilometers to wintering areas during the severe winter of 1971-72, whereas most winter locations remained within the summer fall composite home range during the mild winter of 1972-73. Goats were located on steep slopes or cliffs 49.2% of the time; north and east facing slopes were used most frequently from July through October, but slope use changed to south and west facing slopes in November.

3423. A repeater type biotelemetry system for use on wild big game animals - Ward A.L. and Cupal J.J. - Rocky Mountain Forest Exp. Stat., Laramie, Wyo. - BIOMED.SCLINSTRUMENT. 1974 Vol.10 (145-152)

A repeater type telemetry system was developed and field tested on a wild elk. The telemetry system consisted of the following: heat flow rate sensing implanted transmitter producing relatively low frequency R.F. pulses whose repetition rate was directly proportional to heat flow rate through the hide of the animal. A repeater type neck collar which sensed the presence of pulses from the implant and retransmitted these pulses using a relatively high power, high frequency transmitter. In addition, a second R.F. pulse was generated in the neck collar. The pulse interval for these pulses was related to animal activity. A portable receiving station consisting of a receiver, decoding circuitry and analog chart recorder. Details of circuit design and performance are given. Field experience has shown that this method is extremely useful for the monitoring of biological data from secretive big game animals such as elk.

3424. A telemetry system to monitor temperature of free roaming animals - Newman M. and Weeks R. - Dept. Electron. Engin. Technol., Univ. Nebraska, Omaha, Nebr. 68101 - BIOMED.SCLINSTRUMENT. 1974 Vol.10 (153-156)

This paper describes an inexpensive recording telemetry system used to monitor the deep body temperature of free roaming animals. This system was developed to monitor temperatures of big game animals enclosed in 50 foot square pens. The telemetry system consists of a temperature sensitive implantable transmitter and a receiving station. Temperature information is encoded in the period of the transmitted pulse type signal. Transmission information is encoded in the period of the transmitted pulse type signal. Transmission is in the FM band. The received signal is processed by a period to analog converter and the temperature displayed on a

chart recorder. The telemetry system was successfully tested on domestic sheep. The transmitting device was subcutaneously implanted on the sheeps back and the temperature recorded for approximately a month.

3425. A micropower, multichannel biotelemetry system - Humphries J., Phoebus E. and Globus G. - Dept. Psychiat. Hum. Behav., California Coll. Med., Univ. California, Irvine, Calif. 92664 - PSYCHOPHYSIOLOGY 1974 11/3 (382-387)

In order to gather biodata in the home environment, the authors developed a compact and inexpensive frequency modulation (FM) multichannel subcarrier system employing micropower integrated circuits of the unique lateral PNP design. The subcarrier system may be used with or without a wireless transmitter. One FM transmitter design that has been used is presented. Components for four channels are mounted on a glass epoxy circuit board. More channels may be added and the potential for hybrid film packaging was considered in the design. Standard 7.5% proportional subcarrier frequencies from 400 Hz (ch. 1) to 3000 Hz (ch. 8) may be used, with the center frequency being determined by the value of a single component in the oscillator circuit. The overall simplicity, stability, fidelity, and low power requirements of this subcarrier system facilitate long term unattended recording.

3426. A single channel FM telemetry unit: its design, fabrication and application - Kadefors R., Yon E.T. and Ko W.H. - Engin. Design Cent., Case West. Reserve Univ., Cleveland, Ohio - MED.PROG. TECHNOLOGY 1974 2/4 (197-202)

The development and application of a hybrid integrated FM telemetry transmitter in an implantable flatpack capsule are described. Engineering evaluation of the performance of over eighty units is summarized. The range of performance and the limitations of the transmitter are also discussed. The results indicate that the transmitter can be fabricated in quantity with good uniformity in performance to meet selected needs of the biomedical community.

3.8. Cameras

3427. Zeiss Axiomat, a microscope with a new concept - AXIOMAT VON ZEISS, EIN MIKROSKOP MIT NEUEM KONZEPT - Michel K. - Abt. Mikrosk., Carl Zeiss, Oberkochen - ZEISS INFORM. 1973 21/82 (4-12)

The particular main functions of a universal microscope were partitioned into box shaped building elements with a square base, which can be combined with one another in a highly versatile manner. The main optical axis coincides in principle with the symmetry axis of the building elements. The movable parts required for the adjustment of the image (movement S, Y and Z, rotation around the optical axis) are restricted to a minimum.

3428. Optical properties of the foil lens for the correction of the spherical aberration - Ichihashi M. and Maruse S. - Dept. Electr. Engin., Fac.

Engin., Nagoya Univ., Nagoya - J.ELECTRONMICROSC. (Tokyo) 1973 22/4 (321-328)

Under the thin lens approximation, it is theoretically shown that the spherical aberration of electron lenses should be able to be corrected with a foil lens consisting of an aperture and a conducting foil. At first, the axial potential distribution in the foil lens is derived, and it is proved to agree within a few per cent errors with the potential distribution which is obtained by computation of the Laplace equation. With this analytical potential distribution, the Gaussian focal length f_l and the spherical aberration constant $Cs1$ of the foil lens are represented by the geometrical parameters. Secondly, the spherical aberration of the corrected lens is derived and compared with the experimental results. It is shown that the effective correcting power of the foil lens is properly referred to the ratio $Cs1/f_l$. Thus the fundamental data for designing the foil lens are obtained

3429. Images of truncated sinusoidal and square wave objects formed by a non uniformly illuminated slit aperture - Kumar R., Bhatnagar G.S. and Chopra K.N. - Instruments Design Developm. Cent., Indian Inst. Technol., Delhi - ATTI FONDGRONCHI (Firenze) 1974 29/2 (207-215)

Investigations were made on the effect of amplitude filters on the diffraction images of one dimensional periodic sine and square wave objects formed by a slit aperture. The value of the minimum number of cycles for which the object can be approximated as an infinite cycle periodic target when used in such a system is noted.

3430. The effect of chromatic aberration of the objective on the sensitivity and stability of automatic focusing systems - Denisjuk G.V., Kobozev Y.K. and Trukhmanova T.D. - SOV.J.OPTTECHNOL. 1973 40/10 (603-606)

The sensitivity of an automatic focusing system is not reduced by operation in the region in which the chromatic aberration of the objective is uncorrected, but the focusing plane does not then coincide with the plane of the best photographic image of the camera. The amount of this shift depends on the spectral characteristic of the photoactinic beam of the focusing sensor and the chromatic aberration of the objective.

3431. Apparatus for investigating photographic materials used in holography - Yermolayev M.M. and Mikhaylova Y.I. - SOV.J.OPTTECHNOL. 1973 40/10 (621-623)

An interferometric apparatus is described, and the results of tests of the VRL and LOI 2 holographic materials are presented.

3432. Photographic print washer - Ablyazov R.A., Volkov A.I. and Elembayev Y.N. - SOV.J.OPTTECHNOL. 1973 40/10 (632-633)

The tests of a machine for washing photographic prints in water streams with simultaneous oscillation of the prints are discussed. A brief description and the specifications of the machine are given.

3433. Some measurements of Wiener spectra of

photographic noise - Gorokhovskiy Y.N. and Filimonov R.P. - SOV.J.OPTTECHNOL. 1973 40/10 (653-654)

A test was carried out on pairs of various types of photographic materials deposited on transparent bases, polar in terms of their sensitometric properties.

3434. Spatial filtering to improve transverse tomography - Peters T.M. - Dept. Electr. Engin., Univ. Canterbury, Christchurch - IEEE TRANS.BIOMED.ENGNG 1974 BME 21/3 (214-219)

A new transverse tomographic apparatus is described that enables the tomogram to be related to the ideal image by a linear blurring operation. It is shown that digital and optical linear spatial filtering techniques may be employed to remove the blurring that is present in the tomographic image obtained with the new device. Experimental verification of both restoration methods is presented.

3435. A gas flow proportional counter for Na Ka x radiation - McHardy W.J. and Birnie A.C. - Macaulay Inst. Soil Res., Craigiebuckler - J.PHYSC. SCIENT.INSTRUM. 1974 7/4 (318)

The wavelength spectrometer attachment to the Cambridge Stereoscan S4 scanning electron microscope uses gas flow proportional counters as X ray detectors. Since the standard counter has an unsupported 6 μ m Mylar window which absorbs a high proportion of sodium X rays, it is relatively insensitive for sodium. The alternative is to use the low atomic number counter provided as an optional extra. This counter has a 0.2 μ m collodion window supported on a fine (70% transmission) nickel mesh. Such a window is, naturally, very fragile and, it has been found, lasts for only a few spectrometer evacuations. Since this equipment is designed specifically for the detection of very soft carbon and oxygen X rays, the window seems unnecessarily thin for sodium. The construction and performance of a counter provided with a mesh support is described.

3436. Application of the suppressed frame recording method for magnetic tape recording - ANWENDUNG DES HALBBILDVERFAHRENS BEI DER MAGNETISCHEN BILDAUFZEICHNUNG - Habel F. - Fachber. 13 Automatisier. Techn. Datenverarbeit., Techn. Fachhochsch., Berlin - INTELEKTRON.RUNDSCH 1974 28/7 (131-134)

This report gives the problems to be expected from application of the suppressed frame recording. The question of the mechanical location, main head to repeat head for video repetition is discussed. Consequences of general interferences of the tape run which may occur are also shown.

3437. A micropower pulswidth modulation pulse position modulation two channel telemetry system for biomedical applications - Lin W.C. and Pillay S.K. - Dept. Comput. Informat. Sci. Engin., Case West. Reserve Univ., Cleveland, Ohio 44106 - IEEE TRANS.BIOMED.ENGNG 1974 BME-21/4 (273-280)

A novel micropower, 2 channel telemetry system, which was used to transmit the

occurrence of the QRS complex of the heart waveform and temperature information, is described. The system employs pulsewidth modulation and pulse position modulation methods plus a few unique circuits and system design techniques so that it has the following desirable features. The transmitting unit consumes extremely low power due to low duty cycle and yet delivers high peak power for better receiving. In addition, the unit is compensated (not regulated) for battery voltage variation. By means of adaptive threshold, pulse width discrimination and pulse rate discrimination networks, the receiving unit is relatively noise free in signal identification. Information in analogue and digital form are available at the output for convenience. A prototype system was designed and fabricated. Test results are presented. Due to the availability of the integrated circuits on the market, medical doctors and biologists will be able to duplicate the system if the system size problem is not severe. The authors believe that device or integrated circuit manufacturers would be able to implement it in a much more compact form.

3438. A circular streak camera tube - Kalibjian R., McConaghy C.F. and Coleman L.W. - Lawrence Livermore Lab., Univ. California, Livermore, Calif. 94550 - *REV.SCLINSTRUM.* 1974 45/6 (776-778)

A circular streak camera tube was developed. Initial application resolved 6 psec laser pulses from a Nd:glass laser. The theoretical resolution for this tube is estimated to be less than 2 psec.

3439. Rotating drum scanner display system for digital image processing - Sandor T. and Cagliuso G. - Dept. Radiol., Harvard Med. Sch., Boston, Mass. - *REV.SCLINSTRUM.* 1974 45/4 (506-509)

An electromechanical scanner display system is described that as a scanner measures optical density in transparencies and as display device reconstructs the scanned image from digitally recorded optical density data. The instrument can accommodate image sizes up to 20x25 cm with maximum spatial resolution of 20 line pairs/mm. The optical density data are digitized into eight bits (256 levels) covering a range of 0-2.2 OD at a speed of 28,000 samples/sec. The display part of the system receives data digitized into 256 levels; out of these 95-105 can be distinguished at at output with statistical significance.

3440. A TV scanning method for recording time resolved optical spectra of transients produced by a single pulse of electrons - Gordon S., Schmidt K.H. and Martin J.E. - Chem. Div., Argonne Nat. Lab., Argonne, Ill. 60439 - *REV.SCLINSTRUM.* 1974 45/4 (552-558)

A new method to record the time dependence of transient absorption or emission spectrum produced by a single pulse of radiation is described. The time resolved spectrum is produced by an image converter camera with streak capability. The streak image is scanned by a TV camera, the output of which is transferred to a computer. Apart from its time saving aspect, the method is particularly useful for experiments with rare or radioactive chemicals.

4. COMPUTERS

3441. Microcomputers applied to medical instrumentation - Trautman E.D. - Med. Engin. Dept., Massachusetts Gen. Hosp., Boston, Mass. 02114 - *BIOMED.SCLINSTRUM.* 1974 Vol.10 (101-104)

The advantages of computers in data reduction have long been recognized. The flexibility of programming and the computational power inherent in a digital computer are the most important of these. The advent of microcomputers brings these advantages within reach of the bioengineer developing medical instruments. The bioengineer researching new techniques or methods for extracting new information from existing measurements is faced with collecting data from the biological signals and operating on this data to produce the desired information. If a microcomputer were used to perform this second function, the development effort would be reduced to collecting the data and to programming existing hardware. In addition, this hardware could come packaged as an instrument and could therefore, once programmed, be the instrument. The author experimented with this technique in the design of two medical instruments of quite different functions: a Cardiac Output Computer and a Neuromuscular Transmission Analyzer. Most of the circuitry is the same with different programming. These instruments employ a calculator based microcomputer system of the author's own design. Standardization and digital control facilitate the interconnection of these instruments, either in research or monitoring facilities. Large systems can thus be realized easily. Communication with larger central computers is also foreseen.

4.3. Digital

3442. Structure and properties of the central unit of the digital computer 330 - STRUKTUR UND EIGENSCHAFTEN DER ZENTRALEINHEIT DES PROZESSRECHNERS 330 - Dittmann J. - Bereich Mess- Prozesstechn., Siemens AG, Karlsruhe - *SIEMENS Z.* 1973 47/5 (359-364)

The digital computer Siemens 330 is a further 16 bit computer of the Siemens system 300. In construction it is similar to the 320, but with greater capacity, and compatible. It is particularly suitable for the digital computer technique, by virtue of an extensive command list with hardware multiplication and division (sliding point arithmetics optional), byte and field search commands as well as an autonomous EA processor.

3443. Organizational program for the digital computer 330 - ORGANISATIONSPROGRAMM FÜR DEN PROZESSRECHNER 330 - Herzog K. - Bereich Mess-Prozesstechn., Siemens AG, München - *SIEMENS Z.* 1973 47/5 (364-367)

The manifold applications and the extensibility of the Siemens digital computer 330

require for their optimal exploitation a modular organization program of great flexibility. This requirement has been realized in the organization program (ORG) 330. The user has an extensive spectrum of functions at his disposal in the form of program constructing elements, from which, on feeding, he chooses the version as far as possible adapted to his special needs.

3444. Determination of life times using a digital correlator in true time - DETERMINATION DE VIES

MOYENNES A LAIDE D'UN CORRELATEUR DIGITAL EN TEMPS REEL. Daniere J., Rougny R., Descroix E. et al. - Inst. Phys. Nucl., Univ. Claude Bernard Lyon I, Villeurbanne - NUCL.INSTRUM.METH. 1974 115/1 (165-171)

A digital correlator giving the autocorrelation or the intercorrelation function of 2 signals $X(t)$ and $Y(t)$ in true time is used. The incremental delay is adjustable between 100 ns and 1 s, by 100 ns steps. The application of this correlator to nuclear spectroscopy is studied and different methods used for nuclear lifetimes determination are compared.

3445. Computer crime. Part 2: Data security - Wiesel G. - DATA REP. (Muenchen) 1973 1/4 (24-27)

Possible offences in the field of computer crime and the problems involved in punishing them under criminal law are discussed. The areas of weakness in data processing and the practical possibilities of implementing data security are indicated.

3446. A random address reader - Grianti F., Ottonello P. and Schiavi E. - Ist. Sci. Fis., Univ. Studi, Genova - J. PHYS. SCI. INSTRUM. 1973 6/9 (816-817)

A simple integrated circuit array is described which performs a cyclical reading of memory address in a random way.

3447. Closure properties of some families of languages associated with biological systems - Herman G.T. - Dept. Computer Sci., State Univ. New York, Buffalo, Amherst, N.Y. 14226 - INFORM. CONTROL. 1974 24/2 (101-121)

Some families of languages which originally arose from the study of mathematical models for the development of some biological organisms are described, called families of developmental languages. From the computer scientists point of view, they are all families consisting of languages which are generated by context free grammars, with the difference that at each step of a derivation every symbol in the sentential form is rewritten. Thus, the behavior of these systems is similar to the behavior of other grammars in which context free type rules are applied simultaneously at several points in a sentential form. Such grammars have been under active investigation in recent years. Subfamilies (128 of them) of the largest family of development languages are determined by various biologically and mathematically meaningful restrictions. Due to the parallelism in their definition, each of the families will contain languages which are not context free. However, they are all subfamilies of the context sensitive languages. The closure properties of these families of languages were

investigated and it was found that, in contrast to other recently studied families with parallelism, they are closed under only a few operations. In fact, none of them is an assembler family language (AFL) or a pre AFL. A number of examples is given of how to prove whether these families are closed or not under various operations. The significance of the results is discussed from the point of view of both formal language theory and developmental biology.

3448. Mode of action and prospects of photo electronic memories - WIRKUNGSWEISE UND AUSSICHTEN OPTISCHER SPEICHER - Wilhelmy H.J. - ELEKTRONIK 1974 23/4 (133-134)

Recent developments in holographic computer memories and laser display systems are reviewed.

3449. Page oriented associative holographic memory - Knight G.R. - Xerox Palo Alto Res. Cent., Palo Alto, Calif. 94304 - APPL. OPT. 1974 13/4 (904-912)

Holographic memories are an attractive candidate for future large capacity parallel associative search systems. Parallel retrieval of stored data is essential to many data processing applications, yet electronic implementations of associative memories are very costly. A straightforward extension of more conventional holographic storage techniques can be used to implement an associative memory. The various output beams for a two dimensional page associative store are analyzed and separated to provide the desired output function. A correlation type associative memory is also analyzed and compared with the first system. Applications of these memories are discussed for complex search algorithms and also for the potential of associative data processing.

3450. Floating point arithmetic multiplication - Kelly S. and Macfarlane A.W. - Gen. Instrum. Microelectron., Glenrothes - ELECTRON. ENG. 1974 46/555 (77-80)

Various techniques are available for implementing b.c.d. multiplication, each having its advantages and disadvantages. Whatever the algorithm however, the basic requirements of a multiplication system are that it has the facility to: (a) Store the multiplier and multiplicand. (b) Generate and accumulate partial products. (c) Predict, from the input data, the position of the decimal point in the final answer. This is an added requirement for floating point systems. In this article techniques for implementing (a) and (b) are considered initially and then developed to cover full floating point operation.

3451. Microprogramming: a hardware based definition - MIKROPROGRAMMIERUNG: EINE DEFINITION AUF HARDWARE BASIS - Chroust G. - IBM Lab., Wien - ELEKTRON. RECHENANLAGE 1974 16/2 (49-52)

This paper tries to give a rigorous definition of the concept of microprogramming by reducing it to the concept of a microcontrolled machine. The class of microcontrolled machines can be rigorously defined using the terminology of switching algebra.

5. SPECIFIC MEASUREMENTS

3452. Tests of industrial climate and devices for the transmission of information -

INDUSTRIEKLIMAPRÜFUNGEN FÜR NACHRICHTENTECHNISCHE GERÄTE - Bach H.W. and Cosack U. - Zent. Lab. Nachrichtentechn., Siemens AG, München - SIEMENS Z. 1973 47/5 (373-378)

In the field of information transmission it has long been customary to prevent possible disturbances due to climatological influences by suitable environmental testings. However, in the special field of industrial climate testing the methods used so far no longer answer the new requirements and knowledge. New testing methods were therefore developed, with which reliable statements can be made on the behavior of construction parts and electrotechnical equipment when used in polluted air.

3453. An instrument for recording the motions of microorganisms in chemical gradients - Lovely P., Dahlquist F.W., Macnab R. and Koshland Jr D.E. - Inst. Molec. Biol., Univ. Oregon, Eugene, Ore. 97403 - REV.SCLINSTRUM. 1974 45/5 (683-686)

A relatively simple instrument is described which records the three dimensional trajectories of swimming microorganisms. An important feature is the large sample chamber, which permits prolonged tracking in stable, defined gradients of chemotactic stimulants. Data concerning the motility and chemotaxis of the bacterium *Salmonella typhimurium* are presented.

3454. An inexpensive vacuum operated tweezer - Henrichsen R.E. - Dept. Mining, Metallurg. Ceramic Engin., Univ. Washington, Seattle, Wash. 98195 - REV.SCLINSTRUM. 1974 45/6 (857-858)

The construction of an inexpensive vacuum operated tweezer from a modified aquarium air pump and a disposable syringe is described.

3455. A multi ion mass spectrometer - Van Hulsteyn D.B. and Hearrell L.R. - Dept. Electr. Engin., Univ. Texas, Austin, Tex. 78712 - REV.SCLINSTRUM. 1974 45/6 (819-824)

A multi ion mass spectrometer was developed which allows the simultaneous measurement of the velocity distributions of each of the several ion species contained in a burst of streaming plasma. The device utilized parallel DC magnetic and electric fields to separate the ions according to their charge to mass ratios and collected the ions on sets of discrete targets arranged in linear rows. A COS/MOS digital integrated circuit assembly was used to scan and record, in sequence, the output of the integrators connected to each target. The basic design features, circuitry, and test results are presented.

5.1. Temperature

3456. Temperatures measured with small frequency variations - TEMPERATUREN ANHAND KLEINER FREQUENZÄNDERUNGEN GEMESSEN - Kraus K. - SPSE, Pilsen - ELEKTRONIK 1974 23/3 (90-92)

The signal put out by a Wheatstone bridge is used to alter the frequency of an RC sinewave oscillator, which comprises a Wien bridge. The output signal of the oscillator is converted back into a DC signal by an integrated phase locked loop circuit and is then proportional to the temperature of the platinum resistor in the bridge circuitry. The basic mathematics applying to the application and the design of the circuitry are described.

3457. A simple resistance probe for measurements from 4.2 to 300 K - Mitchell M. - Nav. Ordnance Lab., Silver Spring, Md. 20910 - REV.SCLINSTRUM. 1974 45/5 (708-709)

A simple apparatus for making resistance measurements from 4.2 to 300 K in liquefied gas storage Dewars is described.

3458. An improved insertion type liquid helium Dewar for X band ESR spectroscopy - Matsumura Z., Chikira M., Kubota S. and Isobe T. - Chem. Res. Inst. Non Aqueous Solutions, Tohoku Univ., Katahira, Sendai - REV.SCLINSTRUM. 1974 45/4 (596-597)

A liquid helium Dewar in conjunction with the X band room temperature cavity is reported. The Dewar consists of a fourfold silvered Pyrex glass tube graded to fourfold unsilvered clear fused quartz fingers. A full charge (250 ml) of liquid helium has given about 10 hr of operation.

3459. Calorimeter for measuring heats of wetting of solids in organic media - Topic M., Micale F.J., Leidheiser Jr H. and Zettlemoyer A.C. - Cent. Surface Coatings Res. Lehigh Univ., Bethlehem, Pa. 18015 - REV.SCLINSTRUM. 1974 45/4 (487-490)

A thermistor type adiabatic calorimeter has been designed with the capability of measuring the heat of wetting of high surface area solids in organic liquids. Since the primary source of error in this type of experiment is trace water in the organic liquid, a method has been devised for introducing freshly distilled liquids directly into the calorimeter vessel and for maintaining dry conditions while introducing additional sample bulbs for measurements. The main feature in the design of the calorimeter vessel is the arrangement for removing the sample and readmitting a new sample under a positive pressure of dry nitrogen. This design allows this single bulb calorimeter to achieve the advantages of a multibulb calorimeter for detecting the presence and effects of trace water in the organic wetting liquid. The sensitivity of the calorimeter, which contains a volume of 50-100 ml, was found to have an experimental uncertainty of ± 0.03 cal. A series of heat of immersion experiments of NiO in organic liquids, where consecutive immersions were determined in the same liquid, yielded reproducibility results which were within experimental error and indicated that water was not present in measurable amounts in the wetting liquid.

5.2. Time

3460. An apparatus for fast digital time counting for the further development of chronocyclographical motion analyses by on line computers - EINE DIGITALE ZEITMESSEINRICHTUNG HOHER AUFLÖSUNG ZUR WEITERENTWICKLUNG DER CHRONOCYCLOGRAPHISCHEN BEWEGUNGS-AUFNAHME MIT PROZESSRECHNERN - Heinrichs W. - Abt. Orthop. Physiol., Orthop. Univ. Klin., Münster - EUKLAPELPHYSIOL. 1974 32/3 (227-238)

The author describes a method for chronocyclographical motion analyses marking all points selected for examination by light sensible photodiodes. They were periodically exposed to a V shaped bright figure, produced by a projection apparatus. In this way a temporal pattern of impulses resulted which was registered by a digital counter with a clock of 100 nsec. With the aid of a LAB 81 computer the coordinates of the described marked points were calculated. This method reached an accuracy of measurement of about 0.5 to 1mm. Synchron registered analogue dates can be related to these chronocyclographical coordinates.

5.3. Frequency

3461. Characterization of frequency stability: a transfer function approach and its application to measurements via filtering of phase noise - Rutman J. - Adret Electronique, Trappes - IEEE TRANSDUCER MEASUREMENT 1974 IM 23/1 (40-48)

Frequency stability of high quality signal sources is characterized in the Fourier frequency domain by the spectral density $S(y)(f)$ of the fractional instantaneous frequency deviation $y(t)$, and in the time domain by the Allan variance $\sigma^2(y)(\tau)$. Two wellknown types of measuring apparatus used to evaluate these parameters are analog spectrum analyzers and digital electronic counters, respectively. A detailed analysis of the structure of the relation between $\sigma^2(y)(\tau)$ and $S(y)(f)$ shows that it is possible to define a variance, i.e., a time domain measure, by its transfer function in the Fourier frequency domain, even when no corresponding measurement sequence exists in the time domain. Two different kinds of variance are then defined, which possess different properties for white and flicker phase noises. One of these variances is an estimate of the Allan variance. These variances may be measured by a suitable filtering of phase noise at the output of a phase detector.

5.5. Volume

3462. Fraction collector using ultrasonic technique - Berger J. - Dept. Electron., Boston Univ. Med. Cent., Boston, Mass. 02118 - IEEE TRANSDUCER MEASUREMENT 1974 BME 21/3 (241-243)

A fraction collector using an ultrasonic method to sample volumetrically small quantities of liquid is described in detail. The machine is designed around the parameters of studying the enterohepatic circulation of bile in the intact

animal but may be used in the study of other body fluids.

3463. Method for gravimetric registration of changes in tissue volume - Grande P.O., Jarhult J. and Mellander S. - Dept. Physiol. Biophys., Univ. Lund - ACTA PHYSIOLOGICA 1974 91/2 (211-215)

A technique is described by which changes of tissue volume of a muscle region enclosed in a plethysmograph can be followed in terms of water displacements measured with an electronic gravimetric transducer. Experimental tests show that the method provides accurate recordings of vascular capacitance responses and of transcapillary fluid movements.

3464. A capacitance plethysmograph for measuring small volume changes - Riddle H.C., Brydon J.W.E. and Willoughby D.A. - Dept. Med. Electron. Rheumatol., St. Bartholomews Hosp., London - BIOMED. ENGINEERING (Lond.) 1974 9/7 (301-303)

A system is described for measuring changes of electrical capacitance of up to 10 pF in the presence of static capacitance up to 100 pF, the unknown capacitance, oscillator, power supply and output meter all having a common earth. Its application is presented as a level sensor in plethysmography involving small laboratory animals.

5.8. Density

3465. The Amsterdam infant ventilator and the Ayre T piece in mechanical ventilation - Urban B.J. and Weitzner S.W. - Dept. Anesthesiol., Duke Univ. Med. Cent., Durham, N.C. 27710 - ANESTHESIOLOGY 1974 40/5 (423-432)

A pediatric constant volume time cycled ventilator (Amsterdam Infant Ventilator; AIV) modified from an Ayres T piece to allow for intermittent positive, positive negative, and positive pressure ventilation was evaluated under laboratory and clinical conditions. The unit performed well under standard simulated conditions of decreased compliance and increased airway resistance. It compared favorably with the pediatric version of the Engstrom ventilator. When used by itself as a primary anesthesia system, the T piece section permitted spontaneous, assisted, or controlled ventilation. It was also successfully mated with 4 popular ventilators.

3466. Miniviscometer: a small Couette instrument - McCutchen C.W. - Lab. Exp. Pathol., Nat. Inst. Arthr. Metab. Dig. Dis., NIH, Bethesda, Md. 20014 - BIORHEOLOGY 1974 11/4 (265-277)

Miniviscometer is a Couette instrument that can determine the viscosity vs shear rate relation of a 0.2 cm³ sample of fluid. The inner member, the one that does not rotate, is entirely surrounded by the outer member and is kept from rotating by a magnetic field produced by an electromagnet. The electromagnet current which is just sufficient to prevent rotation is proportional to the viscous torque, and thus to the product of shear rate and viscosity. The inner

member has a conical bottom end that mates with a slightly blunter conical cavity in the outer member. This maintains across the bottom the same shear rate as that between the cylindrical surfaces of the inner and outer member, and serves as a bearing to keep the inner member centralized. Friction of this bearing is kept low by making the inner member as a Cartesian diver and adjusting its density so that it barely sinks in the liquid under investigation.

5.10. Displacement

3467. The use of a small digital computer in position digitising and servo control of film measuring machines - Miller D.B., Price D.R. and Stark J. - Dept. Phys., Imp. Coll., London - *NUCL. INSTRUM. METH.* 1974 117/2 (551-559)

A minicomputer is used to implement digitising and servo control of the movable stages of projection microscope measuring machines. Wherever possible, functions traditionally performed by special purpose digital or analogue electronics are effected by the computer program, thereby minimising external hardware. Count up and count down pulses from incremental digitisers are totalled directly in computer memory using an externally triggered memory increment feature. A non linear servo program, making use of the position and velocity information thus available in the computer memory, moves the stages to any desired point, obtaining optimum response by using phases of constant acceleration and deceleration. The computing power of the general purpose processor allows simple performance of several auxiliary functions with no extra hardware.

5.12. Gas concentration

3468. Evaluation of the Corning 165 pH/blood gas analyzer - EVALUATION DE L'ANALYSEUR DU pH ET DES GAZ SANGUINS CORNING 165 - Clerbaux T. and Nullens W. - Lab. Explorat. Fonctionnelle Cardio Pulmon., Clin. Univ. St. Pierre, Leuven - *BULL. PHYSIO. PATH. RESP.* 1973 9/5 (1219-1230)

The testing of the Corning 165 pH/Blood Gas Analyzer (Medfield, Mass, USA) is described. The time required to reach 99.5% of maximum response for the pH, Po, and Pco₂ electrodes was less than 90 sec. The hourly drift of the pH electrode was less than 0.001 pH units, and of the gas electrodes less than 0.2% of the Po₂ and 0.2% of the Pco₂. The best polarization tension of the cathode of the Po₂ electrode was about 700 mV. A comparison with results obtained by tonometry gave the following regressions: Measured Po₂ = 0.914 Calculated Po₂ + 2.91 (r = 0.999; Syx = 1.22 mmHg; n = 32). Measured Pco₂ = 0.969 Calculated Pco₂ + 0.51 (r = 0.999; Syx = 0.71 mmHg; n = 62). The means of the differences, expressed as absolute values, for duplicate measurements, the standard deviation of these differences and the errors on individual measurements were respectively: 0.0004 ± 0.0007 and 0.0005 pH units, 0.21 ± 0.37 and 0.26 mmHg

for Po₂ and 0.26 ± 0.43 and 0.30 mmHg for Pco₂. The apparatus also calculated HCO₃⁻, total CO₂ and base excess, and the results appeared correct when compared with values obtained from the Severing Haus ruler and by calculation using the Milch formula.

3469. Apparatus for continuous measurement of oxygen requirements of the neonate - GERAT ZUR KONTINUIERLICHEN MESSUNG DES SAUERSTOFFVERBRAUCHES BEI NEUGEBORENE - Michel C.F. and Schubring C. - Zent. Frauenheilk. Geburtsh., Klin., Univ. Giessen - *Z. GEBURTSH. PERINATOL.* 1973 177/6 (449-452)

An apparatus is described which permits continuous registration of oxygen requirements in the neonate and premature infant by differential measurement. The method does not require vasopuncture and does neither interfere with nor endanger the baby. It is simple to use, its results can be well reproduced. Oxygen requirement p/kg body weight is a global parameter of the vital functions of the child. The apparatus appears to be particularly suitable for monitoring endangered neonates and premature babies.

3470. Gas transport resulting from plasma scalpel surgery - Henderson M.R., Link W.J., Glover J.L. and Incropera F.P. - Bioengin. Lab., Sch. Mechan. Engin., Purdue Univ., West Lafayette, Ind. 47907 - *MED. BIOL. ENGINEERING* 1974 12/2 (208-213)

The extent of absorption and the intravascular itinerary of plasma scalpel operating gas were investigated by monitoring the intravascular and exhaled argon partial pressures during canine hepatic surgery. The blood gas analysis was performed continuously, using a mass spectrometer to measure dissolved argon, and, periodically, using a gas chromatograph to quantify all argon ingested, including emboli. To quantify the amount of argon lost through the pulmonary circulation, monitoring took place in the right atrium and the aorta. Experimental results show that the amount of argon absorbed at the incision site and transported through the bloodstream may increase the dissolved argon concentration in the right atrium by as much as 150%. The results also indicate that argon may be present as emboli in the bloodstream, but that argon storage in the tissues is insignificant. The argon concentration in the aorta does not noticeably increase; hence the excess argon is exhaled within one circulation through the pulmonary circuit. These observations were substantiated by the use of an ultrasonic Doppler flowmeter to check for the presence of gas emboli at various locations.

3471. Fiberoptic probe for oxygen saturation and dye concentration monitoring - Johnson C.C. - Dept. Biophys. Bioengin., Inst. Biomed. Engin., Univ. Utah, Salt Lake City, Ut. - *BIOMED. SCI. INSTRUMENT.* 1974 Vol.10 (45-50)

Fiberoptic catheters and instrumentation for continuously monitoring pressure, oxygen saturation, and dye concentration in vivo are available for measurement in the venous system. Applications of this technique to arterial oxygen saturation and dye concentration monitoring have been limited due to the difficulty of inserting a small fiberoptic catheter. An extremely small

fiberoptic probe has been developed which can be inserted through a teflon sheath percutaneously placed in a peripheral artery. The probe design and calibration characteristics are described, along with initial animal and clinical results.

3472. Qualitative fundus oximetry in the albino rabbit's eye - Bakker N.J.A., De Cock C.A., Van Marle G.W. and Ducardus R. - Dept. Ophthalmol., Univ. Rotterdam - *EXPEYE RES.* 1973 17/4 (99-108)

The principle of fundus oximetry, as used by Broadfoot, Gloster and Greaves (1961), has been modified and elaborated, using two monochromatic light bundles, one with minimal, the other with maximal difference in the extinction coefficient for Hb and HbO₂, a high chopping frequency, fibre optics and a Lovac contact lens. Anesthetized albino rabbits were used with the light entering the dilated pupil. The returning light can be divided into a non variable part, originating from various planes of transition, and a part that behaves as if passed through a blood film of twice the vascular layer thickness. Using differential recording, the difference made zero at the beginning of the experiment, a higher sensitivity of the system may be employed than in the case of direct recording of the intensity of the returning light. Changes in oxygenation gave reproducible qualitative measurements of the oxygen saturation of the blood in the vascular layer.

5.14. Radiation

3473. On the shape of the photopeak in a NaI(Tl) scintillation detector - Mudhole T.S. and Umakantha N. - Dept. Phys., Karnatak Univ., Dharwar - *NUCL.INSTRUM.METH.* 1974 116/2 (401-403)

The shape of the photopeak due to the 622 keV line of ¹³⁷Cs is studied using a NaI(Tl) scintillation detector. The higher energy part of the photopeak is found to be a Gaussian, even at high counting rates.

3474. A scratch pad memory for buffering multiwire proportional chamber data - Brown D. - Los Alamos Sci. Lab., Los Alamos, N.M. 87544 - *NUCL.INSTRUM.METH.* 1974 117/2 (561-567)

A scratch pad memory has been developed for rapidly acquiring a series of data words from a group of multiwire proportional chambers. Use of this memory for buffering reduces the effective dead time in experiments involving high instantaneous event rates.

3475. An efficient read out system for multiwire proportional counter hodoscopes - Austin R.W. and Selig W.J. - Space Sci. Lab., NASA/Marshall Space Flight Cent., Huntsville, Ala. 35812 - *NUCL.INSTRUM.METH.* 1974 117/2 (429-434)

An efficient scanning method for read out of a multiwire proportional counter hodoscope is presented. This method which utilizes the grouping of wires in the hodoscope read out system offers distinct advantages in speed and simplicity over systems employing long shift registers. Power consumption and cost can be minimized with this method because of slower

clock speeds and a low parts count. This system has been constructed and used on a hodoscope for cosmic ray trajectory measurements and a lower power version has been designed for satellite applications.

3476. Precautions in the measurement of tritium concentrations in air when using flow through ion chambers - Waters J.R. - Johnston Lab., Inc., Cockeysville, Md. 21030 - *NUCL.INSTRUM.METH.* 1974 117/1 (39-43)

Instruments with flow through ion chambers are frequently used to measure the concentration of tritium gas in air. However, these simple instruments can give erroneous results because of: cigarette smoke, aerosols, ions, ambient gamma ray field changes, moisture and condensation, absorption and memory effects, clogged filters, fission product gases, radon, and incorrect instrument calibration. The causes of these errors are explained and chart recordings are presented showing some of them in action. Most problems can be avoided using the proper instrument design and safeguards described and by adequate calibration techniques. A tritium monitor should be checked and calibrated with tritium gas, not gamma rays or ions. The most accurate calibration is obtained when the instrument operates in a closed loop so that the tritium concentration is constant, a steady meter reading being obtained independent of air flow rate and instrumental time constants.

3477. The extrapolation number in the 'm targets one hit' model - Abillon E. - Groupe Etud. Effets Rayonnem. Struct. Molec., Dept. Biol., Cent. Etud. Nucl. Saclay, Gif sur Yvette - *MAT.BIOSCI.* 1974 19/3-4 (191-200)

In the 'm targets one hit' model without recovery, the extrapolation number is equal to the number of targets m. In this paper is considered what the extrapolation number becomes when the recovery of hit targets is included in this model. It is shown that it is then a function of two parameters: the number of targets m and the ratio of the probability of recovery to the probability of hit: a/a'. An algebraic example for m=2 and a numerical illustration for the values 3 ≤ m ≤ 10 are given. Adding a single target component in this model does not modify the value of the extrapolation number.

3478. A continuous wave photofragment spectrometer - Dzonik M.J. and Yang S. - Dept. Chem., Columbia Univ., New York, N.Y. 10027 - *REV.SCI.INSTRUM.* 1974 45/4 (750-755)

A continuous wave photofragment spectrometer is described which can investigate photodissociative reactions by measuring angular dependent mass spectra of the recoiling photofragments. The three state differentially pumped vacuum system consists of three mutually orthogonal axes: a polarized light axis (high pressure Hg Xe), a molecular beam axis, and a quadrupole mass filter axis. The electric vector of the polarized light is rotated by a stepper motor (1 rpm). The photofragment signal from the tuned amplifier is lock in detected and displayed on a strip chart recorder. Various

inorganic filter solutions are employed in order to suitably excite the desired transitions of molecules with favorable absorption coefficients ($100 \text{ l. mole}^{-1} \text{ cm}^{-1}$) in the spectral range of the excitation source. Signal averaging is accomplished using long lock in amplifier time constants as well as multichannel scaling. The relative merits of cw photofragment spectroscopy are also discussed with particular reference to the photodissociation of large aromatic molecules. From the angular data, the polarization of the transition dipole relative to the detector axis, the lifetime of the excited molecular state, and the relative ease of fragmentation into different channels can be determined.

3479. A simple inexpensive bending magnet system for very low energy ion beams - Ward T.R. and Jiggins A.H. - Dept. Phys., Polytechn. South Bank, London - J. PHYS. E: SCIENT. INSTRUM. 1974 7/7 (520-521)

A small electromagnet system with circular plane face 38 mm diameter pole pieces is described which bends 400 keV protons or deuterons through 7.5° and separates them cleanly from unwanted beam components. It costs less than one fifth the price of a conventional arrangement.

5.14.1. Visible light

3480. Photometer for counting photons - PHOTOMETRE A COMPTAGE PHOTONIQUE - Fayolle R. and Cadenel G. - Dept. Neurophysiol. Cellul., Inst. Neurophysiol. Psychophysiol., CRNS, Marseille - MED. BIOL. ENGINEERING 1974 12/2 (237-240)

The described photon counting photometer is based on a well known principle. After a discussion of the advantages of the method employed and comments on the choice of the photomultiplier, the apparatus and its performance are described. The reliability of the system and its stability are obtained by using the most recent integrated circuits. One of its applications consists of the determination of the dosage of biogenic amines in nerve cell sections by fluorimetry.

3481. An ultraviolet laser microbeam for 257 nm - Cremer C., Zorn C. and Cremer T. - Inst. Humangenet. Anthropol., Univ. Freiburg/Br. - MICROSCACTA 1974 75/4 (331-337)

A laser uv microbeam is described for the wavelength 257 nm which allows microirradiation of preselected sites of living cells with an effective spot size of approx. $0.5 \mu\text{m}$ in diameter, as measured by fluorescence experiments and by uv induced lesions in stained cell specimens and in unstained living cells. The maximum irradiance power density is approx. $10^7 \text{ erg/(s}\cdot\mu\text{m}^2)$. The ultraviolet light is produced by frequency doubling of the 514.5 nm line of a continuous wave argon ion laser. The optical arrangement in the irradiation microscope is similar to that used in a fluorescence incident light microscope. Focusing and observation are done by means of the same quartz objective (100:1).

3482. Vacuum method of producing light absorbing coatings on glass and metals - Samartsev A.G. and Levitina E.I. - SOV. J. OPT. TECHNOL. 1973 40/10 (659-660)

Light absorbing coatings are widely used in optical instrument manufacturing. In many cases coatings are required that have a low reflectivity not only in the visible, but also in the ultraviolet and infrared. Black nickel and chromium coatings are discussed.

3483. Light beam deflector performance: a comparative analysis - Zook J.D. - Honeywell Corporate Res. Cent., Bloomington, Minn. 55420 - APPL. OPT. 1974 13/4 (875-887)

The performance of various types of analog light beam deflectors is summarized, and their relative positions in a deflector hierarchy are defined. The three types of deflectors considered are mechanical (galvanometer) mirror deflectors, acousto optic deflectors, and analog electro optic deflectors. Material figures of merit are defined and compared, and the theoretical trade off between speed and resolution is given for each type of deflector.

3484. Generation of a square wave xenon flash - Fuenfschilling J. and Zschokke Graenacher I. - Inst. Appl. Phys., Univ. Basel - REV. SCI. INSTRUM. 1974 45/4 (598-599)

A combination of a rotating disk chopper with a xenon flashlamp is described that yields an intense, rectangular light pulse of 2 msec duration and with $5 \mu\text{sec}$ rise and decay time.

3485. Detecting near ultraviolet radiation in the presence of visible light - Bartlett D.F., Groft J. and White M.G. - Dept. Phys. Astrophys., Univ. Colorado, Boulder, Colo. 80302 - REV. SCI. INSTRUM. 1974 45/6 (779-780)

The authors describe a system which suppresses the detection of visible sodium vapor light by a factor of about 10^5 relative to near ultraviolet radiation.

3486. Pulsed spectrophotometric chemical relaxation measurements - Olsen S.L., Holmes L.P. and Eyring E.M. - Dept. Chem., Univ. Utah, Salt Lake City, Ut. 84112 - REV. SCI. INSTRUM. 1974 45/6 (859-861)

A pulsed power supply for a 450 W xenon arc lamp was constructed that yields an intense 0.1-10 msec duration square wave flash of light. When combined with an auto offset device the resulting system provides an intense monochromatic sampling beam for the detection of submicrosecond chemical relaxations in an electric field jump cell.

3487. Statistical study of color measurement instrumentation - Marcus R.T. and Billmeyer Jr F.W. - Chem. Dept., Rensselaer Polytechn. Inst., Troy, N.Y. 12181 - APPL. OPT. 1974 13/6 (1519-1530)

In a statistical study of the variability of instrumental color measurement data, two instruments (a Kollmorgen KCS 40 colorimeter abridged spectrophotometer and a General Electric Recording Spectrophotometer equipped with a Davidson and Hemmendinger digital tristimulus integrator) provided three modes of

measurement. Ten samples were measured 48 times in each mode. Frequency distributions were constructed for several colorimetric quantities, including tristimulus values, chromaticity coordinates, and color differences from the mean. To allow study of the error involved in the measurement of color difference pairs, three such pairs were included in the ten samples. The beneficial effects of averaging were quantified.

3488. Power handling capability of glass fiber lightguides - Crow J.D. - Corning Glass Works, Corning, N.Y. 14858 - APPL.OPT. 1974 13/3 (467-468)

This letter reports the propagation of high optical power density over long lengths of low loss, multimode glass fibers. The purpose of the study was to observe the dependence of the attenuation coefficient on input power density and, specifically, to compare any nonlinear behavior in fiber attenuation with the theory of backward directed, stimulated Raman and Brillouin scattering.

3489. A temperature jump apparatus for fluorescence measurements - Rigler R., Rabl C.R. and Jovin T.M. - Karl Friedrich Bonhoeffer Inst., Max Planck Inst. Biophys. Chem., Gottingen Nikolausberg - REV.SCLINSTRUM. 1974 45/4 (580-588)

A new instrument has been designed for the recording of chemical relaxation phenomena induced by a temperature jump, using changes in the nonpolarized and polarized emission of fluorescent molecules. The relative features of techniques for the measurements of light absorption and light emission are discussed specifically in regard to the signal to noise ratios of the measured signals and to problems related to the detection of polarized emission. Examples are given to demonstrate both the performance of the instrument as well as the usefulness of fluorescence measurements in chemical relaxation experiments.

3490. Sensitive technique for measuring differences in reflectivity - Scott W.R., Muldawer L. and Graber M.A. - Temple Univ., Philadelphia, Pa. 19122 - APPL.OPT. 1974 18/3 (1956-1958)

A new technique for measuring reflectivity differences between 2 samples is reported. An electrically driven tuning fork is used to place the 2 samples alternately in the beam of a reflectometer, and a lock in amplifier is used for detection of the difference signal. Advantages of this system include short deadtime vacuum operation and extremely high Q. The sensitivity is such that changes in reflectivity of the order of 0.001% can be observed.

3491. Nematic liquid crystal digital light deflector - Labrunie G. and Valette S. - Lab. Electron. Technol. Informat., Cent. Etud. Nucl., Grenoble - APPL.OPT. 1974 13/8 (1802-1806)

The principle of a new type of digital light deflector utilizing the electrooptic effect of index modulation in nematic liquid crystals and the results of the optical tests that were performed on this device are reported. Optical efficiencies and contrasts, electrical operating conditions, and subsequent turn on times are given. A further experiment concerning the deflection of a colored

image in incoherent white light is described, which shows that this device seems to be interesting for many applications, especially portable ones.

3492. Variable magnification spectrometer - Clement M., Moulin B., Pinet D. and Stevenin P. - Serv. Ionique Gen., Cent. Etud. Nucl., Grenoble - APPL.OPT. 1974 13/7 (1621-1624)

A new high speed spectrometer has been designed for the measurement of the line profiles emitted by pulsed plasmas. This spectrometer, with a Fabry Perot as disperser, presents the essential advantage of possessing an electronic radial scanning, without any mechanical elements. Moreover, the simplicity of the device, the direct visualization of the line profile on an oscilloscope, and the easy digital output for data storage are other advantages.

5.14.3. Infrared

3493. Critical carbon dioxide concentration for Joule Thomson microrefrigerators - Balakov V.V., Preobrazhenskiy R.K. and Andreyeva T.P. - SOV.JOFT. TECHNOL. 1973 40/10 (606-608)

A method is described for determining the critical concentrations of carbon dioxide in the refrigerant gas of microrefrigerators for infrared detectors. The critical values for Linde type microrefrigerators are found.

3494. An apparatus for observing relatively rapid hydrogen deuterium exchange in biopolymers - Suda N., Nakanishi M. and Tsuboi M. - Fac. Engin., Tokyo Coll. Photography, Iiyama, Atsugi shi, Kanagawa - REV.SCLINSTRUM. 1974 45/5 (680-682)

A simple apparatus is described for bringing a protein or a nucleic acid molecule abruptly from an H₂O medium into a D₂O medium and at the same time to introduce the resultant D₂O solution rapidly in a sealed cell for an infrared absorption measurement. It has a small Sephadex column and three magnet valves, and biopolymer molecules are forced to pass the column and are pushed into the infrared cell with D₂O by means of an external pressure of nitrogen gas. By the use of this apparatus an infrared absorption measurement can be started at 10 sec from the zero time, when the biopolymer molecules are brought into contact with the D₂O molecules.

3495. A broadband wavelength calibrator for use with low resolution far infrared monochromators - Siddiqui A.S. and Stewart D. - Dept. Phys., Heriot Watt Univ., Edinburgh - J.PHYS.E.SCIENSTRUM. 1974 7/4 (318-319)

In recent years low resolution far infrared monochromators have been extensively employed in a variety of investigations. To facilitate speedy recalibration of such instruments, special broadband wavelength calibrators are often used. These usually employ polythene powder as the matrix which necessitates relatively sophisticated fabrication to produce calibrators which are easy to handle and have stable characteristics. The authors have successfully constructed a mercuric oxide calibrator using thin polythene sheets

rather than polythene powder as the substrate.

3496. High resolution infrared spectrometer in the 8-10 μm range - Pinson P. - Lab. Infrarouge, CNRS, Univ. Paris VI, Orsay - APPL.OPT. 1974 13/7 (1618-1620)

A double pass SISAM interferometer is presented. Its resolving power is close to 0,011 cm^{-1} . Accurate q constants of 11'0 and 03'0 levels of N.O are calculated using the first spectra recorded.

5.14.4. Radiowaves

3497. Pressure resisting glass cell for high pressure, high resolution NMR measurement - Yamada H. - Dept. Chem., Fac. Sci., Kobe Univ., Kobe - REV.SCLINSTRUM. 1974 45/5 (640-642)

The technique of using a pressure resisting glass cell for high resolution nuclear magnetic resonance (NMR) measurement up to 2000 kg/cm^2 was established. The high pressure NMR experiment is shown to be safely conducted on the ordinary high resolution spectrometer. In this report, a detailed description of the glass cell is given along with an explanation of the device used to transmit the pressure, generated in the standard high pressure equipment, to the glass cell located in the high resolution NMR probe.

3498. A pulsed EPR spectrometer - Huisjen M. and Hyde J.S. - Varian Associates, Instrum. Div., Palo Alto, Calif. 94303 - REV.SCLINSTRUM. 1974 45/5 (669-675)

A pulsed electron paramagnetic resonance spectrometer is described, and applications of the instrument to the determination of longitudinal relaxation times of dilute solutions of free radicals and of spin labeled proteins using the saturation recovery method are discussed. The spectrometer employs a bimodal cavity, the pumping and observing microwave powers are coherent, and all modulating frequencies, delays, and aperture widths are derived from a master clock. Free induction decay signals may be observed in such equipment, and special techniques are introduced to avoid interference of these signals with the saturation recovery signals.

3499. A fast recovery pulsed nuclear magnetic resonance sample probe using a delay line - Lowe I.J. and Engelsberg M. - Dept. Phys., Univ. Pittsburgh, Pa. 15260 - REV.SCLINSTRUM. 1974 45/5 (631-639)

A sample probe for pulsed nuclear magnetic resonance that replaces the normal resonant circuit by a lumped parameter delay line is described. Theoretical analysis shows that the delay line probe has a signal to noise ratio and conversion efficiency of power into rotating magnetic field equivalent to a resonant circuit of $Q = (2 \tau) (\text{delay time}) (\text{Larmor frequency})$. However, the delay line probe has a much wider bandwidth, much shorter transient decay time, and faster recovery from the rf excitation pulse. Experimental results are included that demonstrate submicrosecond recovery times for the observation of the signal.

3500. Computer controlled ENDOR spectrometer - Gruber K., Forrer J., Schweiger A. and Gunthard H.H. - Lab. Phys. Chem., Fed. Inst. Technol., Zurich - J.PHYS. SCIENT.INSTRUM. 1974 7/7 (569-574)

The design and construction of a computer controlled X band ENDOR spectrometer are described. The instrument operates in the RF band 3-39 MHz with a maximum power of 1 kW, corresponding to fields of 80 G peak to peak in the cavity. Details of a new construction for the microwave cavity are given. A minicomputer was used for control of the experiment and data acquisition, processing and display. Examples of the performance are presented.

3501. UHF spin echo spectrometer for the study of impurities in ferromagnetic compounds by nuclear magnetic resonance - Khoi L.D. and Veillet P. - Inst. Electron. Fondament., Lab. Associe. CNRS, Fac. Sci., Orsay - REV.SCLINSTRUM. 1974 45/6 (759-761)

The distinctive features of the tuned spin echo spectrometer described here are high sensitivity, high resolution, simple operation, and a frequency variation throughout the range 170-1700 MHz. In addition to magnetic structure and hyperfine interaction studies, this apparatus is capable of detecting very small concentrations of impurities in ferromagnetic compounds.

3502. High modulation amplitude modification for Varian ESR spectrometers - Goldberg I.B., Lewin A.J. and Crandall J.R. - Sci. Cent., Rockwell Internat., Thousand Oaks, Calif. 91360 - REV.SCLINSTRUM. 1974 45/6 (855-856)

A water cooling accessory was constructed to enable the use of high amplitudes on field modulation electron spin resonance spectrometers. Field modulations greater than 50 G (100 G peak to peak) can be used for long periods without damage to the coils by heating.

3503. Measurement of complex permittivity of liquids at frequencies from 60 to 150 GHz - Van Loon R. and Finsy R. - Vrije Univ., Brussel - REV.SCLINSTRUM. 1974 45/4 (523-525)

A method using standard waveguide components is described for accurate measurements of complex dielectric permittivity of low, medium, and high loss liquids up to 150 GHz. Measurements on cyclohexane, carbon tetrachloride, chloroform, and 1,1,1 trichloroethane are reported. The data of chloroform are compared with results from different authors, confirming an additional absorption above 40 GHz. The method is also suitable for determining the level of the continuous spectra obtainable by far infrared Fourier transform spectroscopy.

5.14.5. Roentgen radiation

3504. X ray fluorescence analysis applicable to elements with an atomic number of less than 22 in substances with a high steam pressure - RONTGENFLUORESCENZANALYSE AUF ELEMENTE DER ORDNUNGSZAHL KLEINER ALS 22 IN SUBSTANZEN MIT HOHEM DAMFDRUCK - John A. and Klein H. - Bereich

Mess- Prozesstechn., Siemens AG, Karlsruhe -
SIEMENS Z. 1973 47/5 (379-381)

The applicability of helium in the roentgen fluorescence analysis with the sequence roentgen spectrometer was studied and a helium rinsing device developed.

3505. A 400 rad flash x ray system for pulse radiolysis - Hinsch H., Scheel H.E. and Niemann E.G. - Inst. Strahlenbot. GSF, Hannover -
REV.SCLINSTRUM. 1974 45/5 (650-652)

The design and working principle of a flash x ray system are described. A two stage Marx generator is used, the charging voltage is 150 kV and the stored energy 1125 J. Anode and cathode are arranged coaxially. The anode consists of a tungsten coated aluminium tube of 20 mm i.d. into which the substances to be irradiated are placed. Measurements of electrical and radiation parameters are described. The x ray dose per pulse is 400 rad, the half width of the pulse is 0.2 μ sec and the mean quantum energy is 44 keV. An example for the application of the system in microsecond pulse radiolysis is presented.

3506. Proton induced x ray emission as a tool for trace element analysis - Folkmann F., Gaarde C., Huus T. and Kemp K. - Niels Bohr Inst., Univ. Copenhagen - NUCLINSTRUM.METH. 1974 116/3 (487-499)

For protons and heavier ions with energies in the MeV range the production of characteristic X rays from elements with $Z > 13$ using a semiconductor X ray spectrometer was studied. Various competing background processes were identified. Theoretical estimates of the background radiation due to bremsstrahlung from secondary electrons and due to proton bremsstrahlung were evaluated, and on this basis lower limits for the sensitivity obtainable for the concentration of the trace element, ranging down to values of 10^{-6} - 10^{-7} were calculated. Different projectiles and incident energies were compared, and it is shown that this method of X ray production is about 3 orders of magnitude cleaner than can be obtained by electron bombardment.

3507. Americium 241 as a low energy photon intensity standard - Campbell J.L. and McNelles L.A. - Dept. Phys., Univ. Guelph -
NUCLINSTRUM.METH. 1974 117/2 (519-532)

A new set of low energy photon intensities per disintegration is obtained for ^{241}Am . This is based on relative intensity measurements with highly collimated Si(Li) and Ge(Li) detectors and on absolute measurements in the narrow energy region 13-16 keV. The results are compared in detail with other recent ^{241}Am data, in the context of their utility for efficiency calibration of Si(Li) X ray detectors.

3508. A parallel plate gas scintillation proportional counter for improved resolution of low energy photons - Palmer H.E. and Braby L.A. - Battelle, Pacific Northwest Lab., Richland, Wash. 99352 - NUCLINSTRUM.METH. 1974 116/3 (587-589)

transparent transparent parallel plate gas scintillation proportional counter was designed which provides improved resolution, more

efficient use of counter volume, and better counting geometry than center wire or spherical anode counters.

5.14.6. α , β and γ radiation

3509. Dosimetry of the SIN biomedical pion beam with tissue equivalent ionization chambers - Cabeza L. - Strahlenbiol. Inst., Univ. Zurich -
FORTSCHR.RONTGENSTR. 1974 121/1 (109-114)

Small tissue equivalent ionization chambers with high pressure gas filling are described. Their calibration with a calorimeter is discussed, and the advantages of comparisons with Monte Carlo calculations of absorbed dose and with a biological dosimeter are examined.

3510. Measurement of low levels of normal uranium in water and urine by liquid scintillation alpha counting - Horrocks D.L. - Sci. Instrum. Div., Beckman Instrum. Inc., Fullerton, Calif. 92634 - NUCLINSTRUM.METH. 1974 117/2 (589-595)

The amounts of normal uranium in water and in urine have been measured as low as 0.1 $\mu\text{g/ml}$ (6×10^{-11} $\mu\text{Ci/ml}$) by liquid scintillation counting methods. An emulsifier system was used to incorporate up to 5 ml of an aqueous solution in a 15 ml counting solution (10 ml of scintillation cocktail plus 5 ml of aqueous solution) with 100% counting efficiency for the alpha particles from the ^{238}U , ^{235}U and ^{234}U radionuclides. Use of a multichannel analyzer allows corrections for the presence of shortlived beta emitters in the uranium decay chain.

3511. A time compensator for large scintillation counters - Faust J. and Larsen R.S. - Stanford Linear Accelerator Cent., Stanford Univ., Stanford, Calif. 94305 - NUCLINSTRUM.METH. 1974 116/2 (365-368)

A circuit is described which develops time invariant pulses for large scintillation trigger counters. For a 8.56 ft long counter, a unit capable of ± 22 ns range is described; the constancy of delay of output for this unit over the full delay range is typically ± 400 ps.

3512. Estimation of gamma ray exposure in mixed gamma neutron fields by ^6LiF and ^7LiF thermoluminescence dosimeters in pair use - Tanaka S. and Furuta Y. - Japan Atomic Energy Res. Inst., Tokai Res. Establishm., Tokai Mura, Naka Gun, Ibaraki Ken - NUCLINSTRUM.METH. 1974 117/1 (93-97)

A procedure to estimate gamma ray exposure in mixed gamma neutron fields using a pair of ^6LiF and ^7LiF thermoluminescence dosimeters is described. In this method, only the shape of neutron spectrum is sufficient to know the exposure. Three types of neutron spectrum, i.e. monoenergetic, 1/E and fission, are investigated for the application.

3513. The realization of a statistical description for complex spectra - Colenbrander A.H. and Kennett T.J. - Dept. Phys., McMaster Univ., Hamilton - NUCLINSTRUM.METH. 1974 116/2 (237-249)

A heuristic treatment is used to explore the possibility of employing a statistical description

for complex spectra. The properties of gamma ray spectra are examined and it is found that several models applicable to such complex data can be derived. One of these models permits the extraction of component density and average intensity for spectra exhibiting any degree of complexity. The effect of finite system response and truncation of records on the estimates for average density and intensity are examined, and the necessary corrections are derived. A localized spectrometer response is assumed. Although examples are taken from the field of gamma ray spectroscopy, the treatment is valid for a large class of spectral data.

3514. Anode surface area and ageing of self quenching (Argon Methylal) GM counters - Peeva A. and Karatoteva T. - Fac. Phys., Univ. Sofia - NUCL.INSTRUM.METH. 1974 118/1 (49-50)

The effect of ageing is studied for self quenching GM counters of differently combined electrode diameters. The results obtained show that: the basic factor contributing to the ageing of a counter is the change of the anode surface area; this change appears in the discharge zone and is developed in three consecutive stages: appearance of a fine powder, appearance of spikes and flakes, and formation of granules situated almost evenly along the anode length. The anode surface could be brought to a state corresponding to a given stage, either through a definite number of recorded pulses, or by a certain intensity of the field, i.e., the change is dependent on the momentum of the products attacking the anode. The investigations are carried out with the purpose of confirming the role of the anode found in previous papers - this role is basic for the operation of the counter.

5.14.7. Neutrons

3515. The interaction of neutrons with fluorine in NE 226 - Bartle C.M. - Univ. Wisconsin, Madison, Wis. 53706 - NUCL.INSTRUM.METH. 1974 117/2 (569-572)

The neutron induced reactions on hydrogen free NE 226 were studied between 6 and 11 MeV. At these energies pulse shape discrimination between charged particle reaction products and electrons is possible. The $^{19}\text{F}(n,p)^{18}\text{O}(g.s.+1)$ reaction is identified through a comparison of the proton response curve for NE 226 and the corresponding curve for NE 231 (having a hexafluorobenzene and benzene solvent material, respectively). From the (n,p) cross sections obtained from the data it is possible to measure neutron flux in a mixed radiation field.

3516. Transmission and reflection properties of a curved copper tube used as a guide pipe for cold neutrons - Hofmeyr C. and Isebeck K. - Atomic Energy Board, Pelindaba - NUCL.INSTRUM.METH. 1974 117/1 (9-16)

It was found feasible to use a copper microwave guide as a curved guide pipe for cold neutrons with wavelengths between 3-15 Å despite neutron optical imperfections. This provides the basis for a simple, flexible and inexpensive design of a small angle scattering

(SAS) facility at a reactor. In order to optimize the SAS system design the transmission characteristics of the microwave guide, which differ considerably from theoretical expectations, were determined in some detail. The reflectivity peaks at 7 Å.

3517. The non elastic cross section of ^{238}U for neutrons between 2.4 and 3.9 MeV - Weaver D.R. and Walker J. - Birmingham Radiat. Cent., Univ. Birmingham - J.PHYS.D:APPL.PHYS. 1974 7/8 (1122-1131)

Shell transmission measurements were made in beryllium with neutrons between 2.4 and 3.9 MeV and analysed by a new method based on the line integral transport equation. The non elastic cross section of ^{238}U was derived.

3518. The dynamics of liquid H_2O and the thermalization of neutrons - Bansal R.M., Tewari S.P. and Kothari L.S. - Dept. Phys. Astrophys., Univ. Delhi - J.PHYS.D:APPL.PHYS. 1974 7/8 (1132-1149)

A study has been made of the asymptotic as well as time dependent decay of neutron pulses in water assemblies at various temperatures in the range 0.5-60°C. A new scattering kernel for neutrons has been proposed which takes account of low energy collective oscillations of H_2O molecules in the Debye approximation and which also includes contributions for rotational and intramolecular vibrational modes. The calculated values of the total neutron scattering cross section for water at 20°C are found to agree rather well with the experimental results. The values of the asymptotic decay constant calculated for different B^0 at various temperatures also agree well with the corresponding experimental results. The temperature variation of the diffusion coefficient D_0 and the diffusion cooling coefficient C is also in agreement with most of the experimental results. Transient spectra in assemblies with different B and at various temperatures are successfully compared with those reported by Ishmaev et al (1965) and Menzel et al (1970). The values of thermalization times t_{th} obtained by the authors are consistent with the waiting times quoted by Ishmaev et al (1965). The importance of introducing rotational and intramolecular vibrational modes, apart from the collective elastic modes, is demonstrated by neglecting the contribution of these other modes. Two cases have been considered: one corresponding to $\theta(D)=200$ K, and these other to $\theta(D)=250$ K. It is shown that under certain conditions the exclusion of rotational and intramolecular vibrational modes markedly affects various neutron thermalization parameters.

3519. Some theoretical considerations of neutron rethermalization near temperature and poisoning discontinuities in light water - Beynon T.D. and Moon J.R. - Dept. Phys., Univ. Birmingham - J.PHYS.D:APPL.PHYS. 1974 7/8 (1150-1158)

A numerical investigation is made of neutron rethermalization effects in light water near physical temperature discontinuities and discontinuities in $1/v$ poisoning. It is shown that calculations of effective neutron temperatures in unpoisoned water systems possessing only temperature discontinuities are insensitive to the details of the scattering model assumed, and that

rethermalization occurs with 1 cm of the temperature interface. However, with or without the presence of physical temperature discontinuities, but with one region poisoned, effective temperature differences of up to 70K exist between predictions using the Nelkin model and the Haywood frequency distribution for the water molecule. In this case, rethermalization occurs up to 2 cm into the poisoned region.

5.14.9. Sound

3520. How much noise is produced by office machines? New methods of measuring to facilitate comparable results - WIE LAUT SIND BUROMASCHINEN? NEUE MESSMETHODEN ERMÖGLICHEN VERGLEICHBARE ERGEBNISSE Editorial - BUROTECHNIK 1974 22/1 (13)

In the middle of the Sixties, the professional organization for office and computer technique appointed a working group for decrease of noise in the office. The results of the determinations are available, and may be used in the planning of office spaces and office buildings.

3521. A solid state converter for measurement of aircraft noise and sonic boom - Zuckerwar A.J. and Shope W.W. - Youngstown State Univ., Youngstown, Ohio - IEEE

TRANS-INSTRUMENT MEASUREMENT 1974 IM 23/1 (23-27)
A solid state converter, used in a system of instrumentation for measuring aircraft noise and sonic boom, features a dual gate field effect transistor mixer and an output stage designed for compatibility with a zero drive amplifier. With a half inch condenser microphone the converter itself has an operating frequency range from dc 28 kHz (-3 dB), a dynamic range of 72 dB, and a noise floor of 50 dB in the band 22.4 Hz to 22.4 kHz. The system requires no impedance matching networks and is insensitive to cable length up to at least 3000 ft.

6. SPECIALIZED INSTRUMENTATION

3522. A simple low cost tensometer for biomaterials testing - Joffe I. and Hepburn H.R. - Dept. Phys., Univ. Witwatersrand, Johannesburg - EXPERIENTIA (Basel) 1974 30/1 (113-114)

A simple and economic device is described and illustrated for the continuous plotting of compressive stress and tension curves of biomaterials.

3523. Human tumors detected by nuclear magnetic resonance - Damadian R., Zaner K., Hor D. and DiMaio T. - Dept. Med., State Univ. New York, Brooklyn, N.Y. - PROC. NAT. ACAD. SCI. USA 1974 71/4 (1471-1473)

Nuclear magnetic resonance (NMR) provides an efficient method for characterizing the chemistry of cancerous tissue (or any tissue) by varying the resonant frequency under investigation until all nuclei of biologic significance have been studied. Small NMR instruments, such as are now commercially

available, could be used at present in the operating room or nearby for rapid diagnosis of tumor specimens taken at surgery. NMR analysis would be rapid compared with the 15-20 min. required for a verdict on a frozen section to return to the operating room. Measurements of the water proton spin lattice relaxation (T_1) in 106 human tumors confirm earlier results with animals. T_1 of all the tumors studied was significantly longer than T_1 of the corresponding normal tissues. Mean standard error and range were reported for T_1 of every human organ and for all the tumor groups studied. This technique should now be considered for use by pathologists as an adjunct to present methods of diagnosing malignancy.

3524. Freezing of nonwoody plant tissues. III. Videotape micrography and the correlation between individual cellular freezing events and temperature changes in the surrounding tissue - Brown M.S. and Reuter F.W. - West. Reg. Res. Lab. Agric. Res. Serv., U.S. Dept. Agric., Berkeley, Calif. 94710 - CRYOBIOLOGY 1974 11/3 (185-191)

A new technique was developed for the observation and recording on videotape of thermal and microscopic changes that occur simultaneously during the freezing of cucumber tissue. The freezing process occurs in two steps. Nucleation and growth of ice crystals in the continuous extracellular liquid phase is followed by nucleation and growth of ice crystals in individual supercooled cells. The freezing of cells in rapid succession causes the average temperature to remain constant for a short time. This mechanism explains the second freezing plateau found in most plant tissue freezing curves.

6.1. Metabolism

3525. The use of low level electrical current for enhancement of tissue healing - Rowley B.A., McKenna J.M. and Wolcott L.E. - Dept. Biomed. Eng., Texas Tech Univ. Sch. Med., Lubbock, Tex. 79409 - BIOMED. SCI. INSTRUMENT. 1974 Vol.10 (111-114)

Two theories have been presented on the critical importance electrical potentials play in the life process. Another theory has also been presented with supporting work on the therapeutic effects of electrical current on single cell infecting microorganisms in vivo. From the work that has been presented there is obviously a cause and effect relationship between electric charge and growth and metabolism. It has been shown that low level of direct current can increase cell growth and metabolism. The gross overall effects have been reported and in some cases inferred, but quantitative results are scarce. However, it definitely appears that, depending upon the technique used, direct electrical current can be utilized to enhance or inhibit the biological system.

6.2. Thermoregulation

3526. Thermistor temperature monitor - Nahrwold M.L. - Dept. Anesth., Univ. Colorado Med. Cent., Denver, Colo. - ANESTH. ANALG. CURR. RES. 1974 53/3 (476-477)

The present report describes a monitor constructed using a thermistor as one limb of a simple Wheatstone bridge. A diagram of the monitor is shown. Temperature is measured with a YSI No. 44005 thermistor (Yellow Springs Instruments, Yellow Springs, Ohio).

3527. Pseudofacility: a method of measurement using suction cup tonography - Todd R. and Woodhouse D. - Wolverhampton Midland Counties Eye Infirmary, Wolverhampton - EXPEYE RES. 1973 17/2 (173-182)

During the suction phase of suction cup tonography the outflow channels are compressed and the intraocular pressure rises towards the critical pressure at a rate proportional to the aqueous inflow. This increase of intraocular pressure was used to calculate the facility of aqueous inflow (pseudofacility) by an adapted aqueous facility equation. The results are discussed and compared with the pseudofacility as estimated by other techniques.

6.3. Digestive tract

3528. Categorical and noncategorical modes of speech perception along the voicing continuum - Pisoni D.B. and Lazarus J.H. - Dept. Psychol., Indiana Univ., Bloomington, Ind. 47401 - J. ACOUST. SOC. AMER. 1974 55/2 (328-333)

Native speakers of English identified and then discriminated between stimuli which varied in voice onset time (VOT). One group of listeners identified a randomized sequence of stimuli; another group identified an ordered sequence of stimuli, in which stimuli from the VOT continuum were presented in a consecutive order. Half of the subjects in each group then received one of 2 discrimination formats: the ABX discrimination test in which X was identified with A or with B, or 4IAX test of paired similarity in which 2 pairs of stimuli, one pair always the same and one pair always different, were presented on each trial. Noncategorical perception of the voicing distinction, reflected by an improvement in discrimination within phonetic categories, was obtained for the group of listeners who experienced both the sequential identification procedure and the 4IAX discrimination test. The results are interpreted as providing evidence for separate auditory and phonetic levels of discrimination in speech perception.

3529. Experimental examinations on laser endoscopy - Fruehmorgen P., Reidenbach H.D., Bodem F. et al. - Med. Dept., Inst. High Frequency Engin., Univ. Erlangen Nuremberg - ENDOSCOPY (Stuttg.) 1974 6/2 (116-122)

In 2 experimental studies, the influence of the argon ion laser beam on the esophagus, stomach, small intestine and large intestine was investigated. The experiments were carried out

using human autopsy material and in acute experiments in the cat. The examinations provided the following results: The beam of the argonion laser produces tissue reactions (edema, coagulation, charring) in the gastrointestinal tract. With the laser beam, a selective effect on the tissue of the gastrointestinal tract can be obtained. The effect of the laser beam examined on the gastrointestinal tract is dependent upon the absorption, the inherent color and the nature of the surface of the tissue. The reaction in the tissue is dependent upon the power applied and the duration of the application of the laser beam. The desired therapeutic effect (coagulation) can better be selected by changing the duration of the application rather than by increasing the power of the laser beam. The location of maximum reaction (coagulation) in the therapeutic range is the submucosa.

3530. Practical endoscopy training using a new gastro intestinal phantom - Classen M. and Ruppel H. - Med. Dept., Univ. Erlangen Nuremberg - ENDOSCOPY (Stuttg.) 1974 6/2 (127-131)

A new gastrointestinal phantom is described which is suitable for the basic training in endoscopy of the upper gastrointestinal tract and the cannulation of the papilla of Vater. Its important characteristics are the true to life, plastic imitation of the inside of the hollow organs and the excellent smooth sliding property, so that the use of all flexible oesophagoscopes, gastroscopes and duodenoscopes presently available can be practised. The incorporation of the training on the phantom into the endoscopic training programme as a whole is discussed.

3531. An apparatus for the synchronous registration of EMG activity in jaw muscles and of vibrations in the masticatory system - Widmalm S.E. and Hedegard B. - Dept. Prosthet. Dent., Univ. Gothenburg - J. ORAL REHAB. 1974 1/2 (183-190)

The apparatus described is a combined instrument for simultaneous recording of vibrations and electromyogram (EMG) activity. It appears to be a useful means of studying reflex mechanisms in the jaw muscles. It is of especial interest as a method of examining the possible effect of vibrations on different receptors, such as the muscle spindles (Matthews, Hannam and Yemm, 1969). Yemm, 1969) The test results presented indicate a satisfactory method for recording of vibration frequencies, the paper speed required for distinct registration suitable for measuring purposes, and the necessity of pre test calibration. They give proof of the simultaneous onset of vibration and contact pressure at tooth contact as well as the occurrence of increased pressure after tooth contact indicating continual muscle fibre contraction.

3532. Detection of airborne particles using optical extinction measurements - Faxvog F.R. - Res. Lab., Gen. Motors Corp., Warren, Mich. 48090 - APPL. OPT. 1974 13/8 (1913-1919)

A method for obtaining real time size distributions of airborne particles is discussed, and experimental sensitivity measurements are

presented. By detecting the transmitted power of a low noise He Ne laser, the optical extinction cross sections of individual particles are measured as they flow through the focused beam. Calculations for various absorbing materials show the extinction cross sections are from one to more than 2 orders of magnitude larger than their scattering cross sections for particle diameters in the 0.02-0.2 μm range. Sensitivity calculations and measurements indicate extinction cross sections down to $2 \times 10^{-12} \text{ cm}^2$ can be detected. This suggests absorbing particles as small as 0.04 μm diam can be measured using this technique.

6.4. Liver and bile ducts

3533. Use of hybrid computers to analyze behavior of detailed models of biological systems.

II. System parameters used in bile salt stimulated biliary cholesterol excretion -

Hardison W.G.M. and Apter J.T. - Sect. Gastroenterol., Dept. Med., Rush Univ. Med. Coll., Chicago, Ill. 60612 - *COMPUT.BIOL.MED.* 1974 4/1 (3-17)

A hypothesis relating biliary bile salt excretion and cholesterol and phospholipid excretion was formalized into a model which could be programmed on an analog computer. Computer curves were generated by entering into the program bile salt infusion rates, parameters derived experimentally for each animal, and certain constants derived from the data. These curves closely approximated the measured biliary cholesterol and phospholipid outputs when other system parameters of the model were scanned systematically with a medium sized digital computer. In this way the model served as a suitable framework for identifying the biological significance of the model parameters.

6.5. Blood

3534. Red blood cell velocity in nailfold capillaries of man measured by a television microscopy technique -

Bollinger A., Butti P., Barras J.P. et al. - Dept. Int. Med., Univ. Zurich - *MICROVASCRES.* 1974 7/1 (61-72)

A television microscopy technique allowing sequential measurements of red blood cell (RBC) velocity in human nailfold capillaries is described. The advantages and limitations of the method are discussed. The physiological pattern of RBC velocity was assessed in 5 normal subjects (6 capillaries). The velocity in the arteriolar limb of the capillaries at rest averaged $0.84 \pm 0.53 \text{ mm/sec}$ (mean diameter $0.0122 \pm 0.0024 \text{ mm}$) and in the venular limb $0.47 \pm 0.29 \text{ mm/sec}$ (mean diameter $0.0152 \pm 0.0028 \text{ mm}$). The range of the velocities measured was 0 (on off flow type) to 3.47 mm/sec . Flow was continuous in 4 subjects with considerable changes of velocity (high standard deviations). In one normal subject an on off flow pattern was observed. The RBC velocity patterns in 2 patients with arterial occlusive disease and with Waldenstrom's macroglobulinemia are given as first examples for measurements in clinical

conditions. In both cases the mean RBC velocity was decreased as compared to the normal subjects. The patient with macroglobulinemia showed a marked reduction of the peak velocity (below 0.1 mm/sec), and the patient with hand and finger artery occlusions, an on off flow type with long periods of RBC standstill. The method may in the future be used to study changes of the microcirculatory pattern in patients with cardiovascular and hematological disorders and to evaluate drug or operative therapy.

3535. Multipurpose folding type saline stand -

Chandra R. - Dept. ENT, Durgapur Steel Plants Hosp., Durgapur - *INDIAN JOTOLARYNG.* 1974 26/1 (47-50)

A new Folding Type Saline Stand is described with multifarious uses in hospital wards and operation theatres. Photographs of the prototype are presented.

3536. Experimental assessment of the Fenwal blood warming system -

Malcolm Thomas B. and Rolly G. - Dept. Anaesthesiol., Univ. Ghent - *ACTA ANAESTH.BELG.* 1974 25/1 (100-110)

The Fenwal blood warmer consists of two electrically heated plates, between which fits a special blood warming bag. This unit was subjected to maximal flowrate ($149.3 \pm 6.3 \text{ ml/min.}$) and to normal flowrate ($36.3 \pm 1.8 \text{ ml/min.}$). It was found to achieve effective blood warming (temperature increase in the first series from 10.2 ± 0.4 to $30.4 \pm 0.2^\circ\text{C}$ and in the second series from 21.8 ± 0.5 to $32.6 \pm 0.2^\circ\text{C}$) without major changes of hemolysis and blood potassium levels.

3537. Experimental and clinical investigations on the warming of whole blood in a high frequency electromagnetic field -

Schricker K.T. and Boehmer H.J. - Surg. Clin., Univ. Erlangen/Nuremberg - *ELECTROMEDICA* 1974 42/3 (89-93)

In massive blood transfusions, warmed blood only should be administered. Basic research was carried out to test the behaviour of stored whole blood warmed up in a high frequency electromagnetic field. The test unit is provided with a thermal switch that cuts out at a blood temperature of about 30°C . On the basis of physical and chemical analyses, the 24 hour survival rate of the Cr^{51} labelled erythrocytes and clinical inspection, this apparatus is well suited for the warming of stored blood. It operates fully automatically and warms stored blood within a short period of time without damaging erythrocytes and plasma. It should be noted, however, that cardiac pacemakers, electric hearing aids and monitoring units can be disturbed.

6.7. Circulation

3538. Accuracy of cardiac auscultation by

microwave - Murphy R.L.H., Block P., Bird K.T. and Yurchak P. - Dept. Occup. Med., Harvard Sch. Publ. Hlth, Boston, Mass. - *CHEST* 1973 63/4 (578-581)

Telemedicine, the practice of medicine at a

distance, offers the opportunity to facilitate cardiac consultation in remote areas to alleviate existing shortages of qualified specialists. For such consultation to be useful, accurate transmission of auscultatory findings is essential. To study this accuracy, auscultation of the heart was carried out on patients with heart murmurs and normal controls through the use of a standard stethoscope and a telestethoscope. The telestethoscope allowed auscultation by an observer situated 2.7 miles away from the 50 subjects. The observer was unaware of the status of the subject with respect to patient or control at the time of the teleauscultation. All murmurs of grade 2/6 or more were easily and accurately described using telestethoscope. Two of the 32 grade 1/6 murmurs were not heard. This study indicates that the telestethoscope is a potentially useful tool for extending the availability of the cardiologist to medically disadvantaged areas.

3539. A method of objectifying the increase of the threshold course - DIE MATHEMATISCHE FORMULIERUNG DES REIZSCHWELLENVERLAUFES ZUR OBJEKTIVIERUNG IHRES ANSTIEGES - Unger F. and Steinbach K. - II. Chir. Univ. Klin., Wien - BIOMEDTECHN. 1974 19/1 (2-5)

Rise in the threshold of stimulation during the first 3 wk after implantation of an intracardiac electrode in the right ventricle is, together with dislocation of the electrode, the most frequent early complication. A connective tissue reaction at the site of implantation is regarded as the cause. The extent of the rise in the threshold does not depend on the values measured on implanting the electrode; even for a low threshold on implantation it may rise to values above the initial voltage of implantable pacemakers. The paper describes a method of calculation which can objectively authenticate the rise in the threshold and so permit comparison of the course in different patients.

3540. Device for measuring the pulse rate in the tail of rats - VORRICHTUNG ZUR PULSMESSUNG AM SCHWANZ DER RATTE - Bauer H. - Lehrst. Arbeitshyg., Hyg. Inst., Martin Luther Univ., Halle Wittenberg - ZVEREUCHSTIERK. 1973 15/5-6 (358-360)

A device for bloodless counting of the pulse rate at the tail of a conscious rat is described. The pulse wave is transmitted in the form of pressure pulsations from a miniature cuff to a transducer equipped with semiconductor strain gauges. The sphygmogram is recorded by a single channel electrocardiograph, and the pulse rate is obtained by counting.

3541. The use of Fourier harmonic analysis for clinical evaluation of the form of the pulse wave - POUZITI FOURIEROVY HARMONICKE ANALYZY PRO KLINICKE HODNOCENI TVARU TEPOVE VLNY - Oliva I., Iper J. and Kotikova K. - Cent. Klin. Farmakol., Inst. Klin. Exp. Med., Praha - CASLEK.CES. 1974 113/5 (148-152)

The paper describes the use of Fourier harmonic analysis for clinical purposes based on a simplified methodic procedure for evaluation of the pulse wave consisting in the representation of results by means of simple graphs for frequency spectrums of amplitudes and profiles of

amplitudes, which characterize in a fairly marked way, yet with complete objectiveness the behavior of elastic processes in the artery at individual segments of the arterial blood stream of the lower extremity.

3542. Roentgenologic volumetry of the heart using a television unit for evaluation - DIE RONTGENOLOGISCHE VOLUMENMESSUNG AM HERZEN MIT HILFE EINER FERNSEH AUSWERTEINHEIT - Schott O. and Maass W. - Abt. Entwickl., Unternehmensbereich Med. Techn., Siemens AG, Erlangen - RONTGEN BL. 1974 27/3 (118-126)

An electronic method is described, by which the volume of the cardiac ventricles and of the entire heart can be determined by X ray. After transforming the X ray pictures into television signals, the contours of the projections of the body to be measured can be determined. Electronic evaluation of these contours produces a value for the volume which takes into account radiographic enlargement and other necessary corrections. The evaluating unit and its utilization are described. The accuracy of the measurement depends primarily on how accurately the doctor can trace the contour of the body to be measured. The error factor can be disregarded.

3543. The question of the lifetime of the sources of energy of implanted cardiac pacemakers - ZUR FRAGE DER LEBENSDAUER DER ENERGIEQUELLEN IMPLANTIERTER HERZSCHRITTMACHER - Mulch J., Hehrlein F.W. and Wick E. - Kardiovask. Abt., Chir. Univ. Klin., Justus Liebig Univ., Giessen - THERAPIEWOCHEN 1974 24/15 (1600-1606)

The current status of pacemaker treatment is reported with particular reference to the operational times of impulse generators. The running time is now being extended by using isotope batteries with conventional switch electronics and also by conventional chemical battery elements combined with an improved energy saving pacemaker circuit. The devices now available are described and personal experiences with 16 implanted plutonium pacemakers and 32 omnicon pacemakers reported. Both systems have so far given good service; in particular the programming of the omnicon pacemakers has given no problems. A longer follow up period will be necessary before making a final judgement on the new pacemaker devices.

3544. Comparison between air plethysmography, mercury plethysmography and venous occlusion rheography - VERGLEICHENDE PLETHYSMOGRAPHISCHE UNTERSUCHUNGEN MIT LUFTPLETHYSMOGRAPHIE, QUECKSILBERPLETHYSMOGRAPHIE UND VENENVERSCHLUSSRHEOGRAPHIE - Mulz D. and Koenig E. - I. Med. Abt., Stadt. Krankenh., Munchen/Schwabing - Z.KARDIOL. 1974 63/4 (358-374)

The three methods are compared with regard to their consistency and efficiency for routine clinical use. In air plethysmography and mercury plethysmography the external volume expansion was measured and in venous occlusion rheography changes in the electrical conduction value were measured. The measurements were made on the forearm of the subjects in the supine position and in the resting state. After

compression of the upper arm, changes in the circulation were recorded with a compression curve. The measurements were conducted on the same patient simultaneously with the air and mercury plethysmogram and in a 2nd experimental design with the mercury plethysmogram and venous occlusion rheogram. The percentage volume change of corresponding segments of the synchronous curves was measured and compared. These were replaced by a curve which represented the percentage deviation of the compression curve. These single curves were calculated to a summation curve of the particular experimental sequence and the methodical percentage deviations were shown in relation to the compression curve. In the optimal range of the air plethysmogram (middle part of the compression curve), only unimportant differences occurred in comparison to the mercury plethysmogram. However, only the mercury plethysmogram gives linear and precise results in the initial part of the measurements. No comparison was possible between the venous occlusion rheogram and the mercury plethysmogram due to large deviations. The mercury plethysmogram is superior to both other methods and represents the method of choice. The air plethysmogram is more time consuming and less useful for recording volume changes immediately after compression.

3545. Comparison of the performance of the Frank lead placement system and the McFee Parungao lead placement system in normal infants by QRS spatial curve analysis - Ainger L.E. and Dixon P.R. - St Jude Child. Res. Hosp., Memphis, Tenn. 38101 - *CARDIOVASCRES* 1974 8/1 (138-144)

Frank lead placement and McFee Parungao axial lead placement system recordings were obtained at the same recording session on each of 110 normal 4 mth old infants. The spatial characteristics of the electrocardiogram as recorded by these systems are compared in the format of QRS spatial curves derived from paired observations. The McFee Parungao axial lead system recorded greater spatial magnitudes and velocities than did the Frank system. Individual variation among the normal patients was large but both systems were comparable in this respect. The McFee Parungao axial system recorded a more anterior orientation of the spatial azimuth and recorded this spatial vector component with greater individual variation than did the Frank system. Both lead placement systems recorded spatial elevation in an almost identical manner. It is concluded from this study that the Frank lead placement system may have a slight degree of superiority over the McFee Parungao axial lead placement system in regards to uniformity of performance in the group of infants studied. Additional conclusions derived from this study are: that each lead system employed clinically must be analysed quantitatively in order to differentiate the normal record from the abnormal record; and that the ideal lead placement system for electrocardiography and vectorcardiography will probably never be achieved. Therefore, selection of a lead placement system for spatial

vectorcardiography, like the selection of a digitalis preparation, is a matter of individual preference, and knowledge of the performance characteristics of that system is essential for its interpretation.

3546. The effect of radar on cardiac pacemakers. II. Interference testing of noncompetitive implantable pacemakers - DER EINFLUSS VON RADARSTRAHLUNG AUF HERZSCHRITTMACHER. II. UNTERSUCHUNGEN SYNCHRONISIERBARER IMPLANTIERBARER SCHRITTMACHER - Roehl D., Laun H.M., Hauber M.E.T. et al. - *Sekt. Kardiol. Angiol., Zent. Inn. Med. Kinderheilk., Univ. Ulm* - *Z.KARDIOL* 1974 63/5 (444-460)

The interference susceptibility of 16 noncompetitive cardiac pacemakers to radiation from the SRE LL 1 radar system was investigated. During bench testing under worst case conditions all pacemakers could be inhibited or triggered, depending on their mode of operation, by the radar beam at peak power densities between 25 $\mu\text{W}/\text{cm}^2$ and 62.5 mW/cm^2 . At higher power densities it was possible to elicit pacemaker impulses from several R wave inhibited units and to trigger all R wave synchronous units within their refractory period. 3 of 4 implanted unshielded pacemakers showed signs of interference in the vicinity of the prototype of the SRE LL 1 radar system; 2 implanted metal shielded pacemakers remained undisturbed when tested at the same location.

3547. A method of vectorial evaluation of the ECG in the horse - EINE METHODE ZUR VEKTORIELLEN AUSWERTUNG DES ELEKTROKARDIOGRAMMS BEIM PFERD - Grauerholz H. - *Klin. Pferdekrankh. Allg. Chir., Freie Univ., Berlin* - *ZBLVETERINARMED. REHIE A* 1974 21/3 (188-197)

Because of the size and nature of the data, a complete evaluation of the information provided by vectorial ECG can only be obtained by the use of electronic data processing equipment. A computer program was constructed to evaluate the ECG of the horse. It enabled a descriptive assessment to be made of the heart action and allowed the data from several ECGs to be analysed and the mean, scatter and extreme values to be calculated and figures to be derived for normal values.

3548. Continuous monitoring of cardiac output - Mackay R.S. and Hechtman H.B. - *Dept. Surg., Boston Univ., Boston, Mass.* - *BIOTELEMETRY* 1974 1/1 (21-30)

Placing an ultrasonic probe on the chest allows measurement of flow in the aorta and its diameter, thus allowing continuous measurement of cardiac output on a beat to beat basis (stroke volume). Probe orientation is not critical, allowing telemetry. Changes in flow are more accurately measured than flow, perhaps requiring a supplementary dilution observation for certain purposes.

3549. Hemodynamic problems after total heart replacement by artificial blood pumps - UBER DIE HAMODYNAMIK NACH TOTALERSATZ DES HERZENS MIT KUNSTLICHEN BLUTPUMPEN - Krautzberger W., Clevart D., Keilbach H. et al. - *Chir. Klin., Klin. Westend,*

Freie Univ., Berlin - LANGENBECKS ARCH.CHIR. 1974 335/sup. (25-28)

Ten experiments of total heart replacement on calves which survived more than 20 hr are described. The artificial blood pumps were capable of supplying a sufficient cardiac output. In animals surviving for a longer period of time an increase of right atrial pressure and a decrease of the total peripheral resistance was observed.

3550. Doppler ultrasound monitoring of venous gas bubbles in pigs following decompression with air, helium, or neon - Powell M.R. - Ocean Syst., Inc., Union Carbide Corp. Techn. Cent., Tarrytown, N.Y. 10591 - AEROSPACE MED. 1974 45/5 (505-508)

A total of 42 simulated dives were conducted with pigs on a series of profiles of graded severity using either helium, neon helium, or air as the compression gas. Using the Doppler ultrasound bubble detector, the number of venous bubbles was determined after reaching the surface. This bubble count was compared with the outcome of the dive with respect to the severity of decompression sickness signs. A comparison of the Doppler signals with dive outcome indicates that a premonitory indication of decompression sickness can be made better when helium or neon is used rather than air. The difference between these gases with regard to Doppler predicted limb bends is explained on the basis of their solubility in adipose tissue.

3551. Ultrasonic duplex echo doppler scanner - Barber F.E., Baker D.W., Nation A.W.C. et al. - Cent. Bioengin., Univ. Washington, Seattle, Wash. 98195 - IEEE TRANS.BIOMED.ENGNG. 1974 BME 21/2 (109-113)

Ultrasonic B mode displays are produced by a new diagnostic scanner that yields dynamic Doppler information from blood flow in addition to both static and dynamic echo information from stationary and more slowly moving tissues. The effect is produced by combining the flow imaging capability of a multigate pulse Doppler flow detector with a fast rotational pulse echo B mode scanner. The duplex system was designed for performing ultrasonic echo Doppler arteriography where the location and geometry of the interface between occlusive atherosclerotic tissue and blood is of prime concern. Initial results on normal arteries in vivo are illustrated. Spatial alignment of echo and Doppler images is obtained by using the same transducer and scanning mechanism for both. However, clinical trials on patients with verified occlusive arterial disease indicated a two transducer system would be more desirable. It is concluded that superposition of images of both tissue and blood decreases the uncertainties inherent in the display of either image alone.

3552. Experimental testing of a permanent rechargeable cardiac pacemaker - Love J.W., Lewis K.B., Fischell R.E. and Schulman J. - Santa Barbara Med. Clin., Santa Barbara, Calif. 93102 - ANN.THORAC.SURG. 1974 17/2 (152-156)

A one stage technique for creating complete heart block and implanting a permanent cardiac pacemaker in the dog is described. The animal test model has been used in the development of

a rechargeable pacemaker system over a five year period. In vivo testing led to the identification and solution of several problems in the laboratory prior to clinical use of the system.

3553. A chronically implanted cuff for occlusion of dog's pulmonary artery during exercise - Platts R.G.S. and Wilson P. - Dept. Exp. Surg., Trinity Coll., Dublin - CARDIOVASC.RES. 1974 8/3 (439-442)

A design for an easily made, chronically implanted, inflatable cuff for total occlusion at will, during exercise of the pulmonary artery in the dog is reported.

3554. Transmission properties of viscoelastic heart catheters - UBERTRAGUNGSEIGENSCHAFTEN VISKOS ELASTISCHER HERZKATHETER - Pfeiffer B. and Hinz R. - Abt. Biomed. Techn. Krankenh. Techn., Med. Hochsch., Hannover - BIOMED. TECHN. 1974 19/3 (92-98)

Methods of correcting blood pressure signals, measured through catheters, are given. A theory for isotropic, viscoelastic and cylindrical catheters, based on physical material data of catheter and pick up systems results in an expression for its frequency response. It allows the formulation of a quality factor for catheters tailored to the spectrum of the intraventricular pressure pulse. Calculated output signals demonstrate typical changes in the observed signals.

3555. Comparative studies of 'state of the art' and presently used clinical cardiac pacemaker electrodes - Tyers G.F.O., Torman H.A. and Hughes Jr H.C. - Dept. Surg., M.S. Hershey Med. Cent., Pennsylvania State Univ., Hershey, Pa. 17033 - J.THORACCARDIOVASC.SURG. 1974 67/6 (849-856)

Two commonly used clinical cardiac pacemaker leads were compared with 2 'state of the art' electrode systems. Energy requirements were determined by direct measurement of threshold current and voltage needs, including polarization losses, and the differences in electrode performance were explained by consideration of a multiplicity of previously studied design parameters. The differential current density lead is theoretically optimal and, in short term studies, required the least threshold energy. However, the practical considerations of ease of placement and questionable long term stability preclude its clinical use at present. The ball tip electrode requires somewhat greater threshold energy than the differential current density electrode but very significantly less energy than any of the standard clinical leads in common use. Transvenous insertion is facilitated, and stability problems have not been encountered in a preliminary clinical test of over 1 yr duration. The high current density ball tip lead is the logical choice for use with a new generation of low stimulus energy pacemakers, whether nuclear, conventional, solid state, or rechargeable power sources are used.

3556. Measurement of QD systolic time interval with an ear lobe densitometer - Korbell G.K., Ko W.H. and Zollinger Jr R.M. - Case West. Res. Univ., Cleveland, Ohio 44106 - BIO-MED. ENGINEERING (Lond.) 1974 9/6 (250-251)

A densitometer can be used to detect the pressure waveform, as the blood pulses through the capillary bed of the ear lobe. Using this principle it is possible to compare the features of the pressure waveform and the features of the ECG simply and noninvasively and thus obtain information about cardiac performance.

3557. E.C.G. amplifier - Narasimha Rao C. and Venkata Reddy K. - Lab. Nucl. Res. Andhra Univ., Waltair - INDIAN J.MED.SCI. 1974 28/1 (21-25)

The design and details of a high gain E.C.G. amplifier are given. It can be used as a plug in module for the electrocardioscope described earlier. The amplifier has a maximum gain of 10^4 , input impedance of the order of 2 Mohms and has a high common mode rejection factor.

3558. A simple 'variable blade' laryngoscope for use in animals - Elliott R. - Dept. Surg. Sci., Roy. Postgrad. Med. Sch., London - BRIT.VET.J. 1974 130/3 (255-258)

A simple variable blade laryngoscope is described in which a single adjustable blade allows its use in a number of animal species. Adjustment is possible before or during use and the shape of the blade ensures increased area of visibility.

3559. Prevention of deep vein thrombosis due to stasis - Brehnan K. and Kline J. - Biomed. Engin. Program, Univ. Miami, Coral Gables, Fla. 33124 - IEEE TRANS.BIOMED.ENGG 1974 BME 21/3 (232-237)

Deep vein thrombosis due to stasis in the lower extremities commonly occurs in surgery or during prolonged periods of bed rest. A system to prevent stasis was developed consisting of a three compartment pressure cuff, a pneumatic source, and an electronic controller. The cuff is designed to be placed on the lower extremities over the calf. Each section of the cuff is sequentially and intermittently compressed. The sequential action for this compression is developed by an electronic controller that regulates the pressure, periodicity and duration of the compression. Results show that a pressure wave can be developed that squeezes and propels the blood anteriorly through the venous system so when the pressure is released the venous system refills.

3560. Common left coronary cannula not requiring dissection for use in dogs - Eckstein R.W. - Dept. Med., Case West. Reserve Univ., Cleveland, Ohio 44106 - JAPPL.PHYSIOL. 1974 36/3 (379-380)

A cannula has been developed for use in the common left coronary artery of dogs which does not require dissection. It is introduced through the left subclavian artery and held in the coronary ostium with an external clamp. The important aspect is a silicone rubber tip which is cast in a split mold and cemented on the tip of a rigid metal cannula. The technique of construction is described and several tips to fit various types of common left coronary arteries are shown.

3561. Video log: a technique for recording analog signals in the television video format - Schuette

W.H. - Dept. Electron. Engin., Div. Res. Serv., Nat. Inst. Hlth, PHS, DHEW, Bethesda, Md. 20014 - BIOMED.SCLINSTRUMENT. 1974 Vol.10 (51-54)

Video recording of televised fluoroscopic images can be of significant assistance in analyzing medical diagnostic patterns for geometric and densitometric features. Frequently it is desirable to correlate the measurements of the televised image with analog signals that were available when the image was recorded. Although techniques are available for multiplexing analog signals onto the audio channel of a video recorder, these signals are not available during stop field or slow motion playback. Additionally, video disk recorders do not include audio capability. A video log system is described that converts the analog signals from 3 data channels into 3 pulses which are inserted into the first 3 lines of each television field, the pulse widths being proportional to the amplitude of the respective analog signals at the time of recording. On playback the pulses are demodulated into the equivalent signal levels.

3562. Fluidic controlled pneumatic pulsatile flow pump for total extracorporeal circulation - Christopher R.A., Rainer W.G., Sadler Jr T.R. et al. - Dept. Mech. Engin., Univ. Colorado, Boulder, Colo. 80302 - BIOMED.SCLINSTRUMENT. 1974 Vol.10 (67-70)

There is considerable evidence that prolonged non pulsatile flow during open heart surgery may impair body organ functions in numerous ways including increased renin release, impaired tissue function, interference with lymphatic drainage, decreased urine output and the formation of edema. In 1964, a unique experimental total extracorporeal pulsatile pump was designed, which showed promise when used on dogs. This pump differed from commercially available pumps since it provided a relatively normal pulse wave contour complete with a sharp diastolic notch, an adjustable stroke, and caused minimum hemolysis; however, this pump was dependent upon both electric and air supplies and there was no provision for manual operation, thus preventing its use on patients. This pump has been extensively redesigned so that it is dependent only on a single air tank for its entire operation. A variable pulse rate fluidic timer, which controls the fluidic valves of the air motors, and a means for manual operation, which bypasses both the fluidic timer and the air motors, have been incorporated in the new design.

3563. A method for determining the origin of a ventricular extrasystole - Clark D.L. - BIOMED.SCLINSTRUMENT. 1974 Vol.10 (115-120)

In order to determine the relationship between the origin of the ventricular extrasystole, and the risk of sudden death, a simple and reliable method of origin determination is needed. This paper presents such a method developed from vectocardiographic data obtained from patients undergoing cardiac catheterization. The results of this study indicate that in general the spacial orientation of the maximum QRS vector of the ventricular extrasystole is away from its origin. More specifically ventricular extrasystoles

originating in the right ventricle have a maximal QRS vector orientated to the left posterior, and may be either superior or inferior. Ventricular extrasystoles from the left ventricle have maximal QRS vectors orientated to the right and anterior, and may be either superior or inferior. They may also occur in the right, posterior, superior octant, and in the most superior or inferior regions of the right anterior section. When these results were applied to the data reported recently by the Coronary Drug Project Research Group it was found that there was a three fold greater risk of sudden death if the ventricular extrasystoles originated in the left ventricle.

3564. The effect of radar on cardiac pacemakers - Roehl D., Laun H.M., Hauber M.E.T. et al. - Dept. Cardiol., Univ. Ulm - BIOMED.SCI.INSTRUMENT. 1974 Vol.10 (133-138)

The susceptibility of 16 noncompetitive cardiac pacemakers to radiation from a powerful radar system was investigated in the laboratory and in the vicinity of its prototype. From comparative in vitro tests in air, fat, water and saline it was concluded that only tests in fat or air represent the worst case condition after implantation. In air all pacemakers showed signs of interference at pulse power densities between 0.025 mW/cm² and 62.5 mW/cm². Three of six implanted pacemakers were triggered or inhibited depending on their mode of operation when tested at a location 1.2 km away from the radar station by the radar beam occurring every 5.5 sec. Because interfering radiation can enter the pacemaker circuitry directly and along the electrode acting as an antenna metal encapsulation of the pulse generator does not provide sufficient shielding against microwave radiation. Pacemakers modified by metal encapsulation and a low pass filter at the electrode however remained undisturbed at pulse power densities of > 10 W/cm² when tested under worst case conditions in air.

3565. Electro optical system for monitoring activity of heart cells in culture: application to the study of several drugs and scorpion toxins - Fayet G., Couraud F., Miranda F. and Lissitzky S. - Lab. Biochim. Med., Fac. Med., Marseille - EUR.LPHARMACOL. (Amst.) 1974 27/2 (165-174)

An electro optical system for monitoring and recording contractile activity of cultured heart cells is described. The system is based on the use of a commercially available electro optical displacement follower aimed at the image of a cell membrane medium interface viewed on a television screen. The system allows the continuous recording of rate, amplitude and rhythm of contractions of single or clustered heart cells. Cultures of heart cells obtained from 11 day chick embryos were used to test the activity of several pharmacological agents including adrenoceptor stimulants, calcium channel blocking agents, ouabain, tetrodotoxin and scorpion toxins.

3566. Recording skin resistance and beat by beat heart rate from the same pair of dry electrodes - Geddes L.A., Bourland J.D., Smalling R.W. and Steinberg R.B. - Div. Biomed. Engin., Dept.

Physiol., Baylor Coll. Med., Houston, Tex. 77025 - PSYCHOPHYSIOLOGY 1974 11/3 (394-397)

Changes in skin resistance and beat by beat heart rate, derived from the EKG, were obtained from the same pair of dry silver electrodes applied to the finger tips. The electronic criteria to be satisfied for application of this technique are discussed. The recording system was constructed using low cost, solid state circuitry. A typical record of changes in skin resistance and beat by beat heart rate is presented to demonstrate the performance characteristics of the equipment.

3567. Apparatus with logical cells - LES RESPIRATEURS A CIRCUIT LOGIQUE - De Courcy A. - Hop. Necker, Paris - AGRESSOLOGIE 1974 15/B (31-46)

There are 2 types of respirator with logical pneumatic cells operating at fixed frequency. 2 Celog, 2 Ercelog, R Airvox, 03 Logic and S Monnal are flow cutting machines in which the feed pressure is high and the flow rate constant. The I/E (inspiration/expiration) ratio, preset in the factory, is 1/2. Ventilation rate is thus known. These are fairly primitive machines, without complex design, adapted for first aid and emergency use. The second type of respirator (pneumatic logical circuit machines) use a flow cutting device to drain a bellows or balloon located in a tightly enclosed space. They are somewhat similar to heavy fixed frequency respirators, e.g. the Engstrom model. The logical pneumatic circuit is also used in other forms of respirator and does not necessarily entail fixed frequency and preset ventilation rate.

3568. An improved method for echographic detection of left atrial enlargement - Brown O.R., Harrison D.C. and Popp R.L. - Cardiol. Div., Stanford Univ. Sch. Med., Stanford, Calif. - CIRCULATION 1974 50/1 (58-64)

Echographic dimensions of the aortic root and left atrium were compared in 170 patients in order to assess dilation of the left atrium with reference to the relatively nondistensible fibrous aortic root. In 50 patients without cause for left atrial or aortic enlargement, the ratio of left atrial/aortic root dimension was 0.87 to 1.11. In 80 patients with known cause for left atrial enlargement, the left atrial/aortic root ratio was ≥ 1.17 . In 40 patients with isolated aortic valve disease, dilation of both the aortic root and the left atrium resulted in a left atrial/aortic root dimension ratio < 1.17 in some patients. Despite this consideration, the comparison of left atrial and aortic root dimension appears to be as specific as, and more sensitive than, previously proposed methods for the evaluation of left atrial enlargement.

3569. Thin film gauges for fluctuating velocity measurements in blood - Clark C. - Dept. Engin. Sci., Univ. Oxford - J.PHYS.E SCIENT.INSTRUM. 1974 7/7 (548-556)

The frequency response has been determined for 2 probe designs used for cardiovascular measurements: one conical, the other cylindrical. The frequency range was 1-1000 Hz using an oscillatory velocity component

superimposed on a mean flow; the test fluid was water. The amplitude response to the fluctuating component was found to depend on the Strouhal number (a normalized frequency) and was almost independent of the amplitude of oscillation. At small Strouhal numbers the behavior is quasi steady; at higher values the sensitivity progressively diminishes, but for the cylindrical probe there is an intermediate region of increased sensitivity. The oscillatory component had no effect upon the conical probe sensitivity to the mean velocity, whereas the cylindrical probe showed an increasing apparent mean velocity for some conditions. Fluctuating velocity values were inferred from steady flow calibration data and, therefore, a detailed comparison was made between such calibrations in blood and water. The effects of probe misalignment upon the accuracy of measurement were also examined, and examples of velocity profiles determined in pipe flow are included.

6.8. Respiration

3570. Clinical evaluation of a new electronic spirometer - Cox P., Miller L. and Petty T.L. - Pulmon. Dis. Div., Dept. Med., Univ. Colorado Med. Cent., Denver, Colo. - CHEST 1973 63/4 (517-519)

An electronic spirometer which utilizes a thermistor and an linearizing circuit, was evaluated. When compared to a Collins 13.5 liter water seal spirometer, 60 test results from 30 patients revealed no clinically significant difference in forced vital capacity, forced expiratory volume in one second, or maximum voluntary ventilation.

3571. Upper limits of resistance of apparatus for inhalation analgesia during labour: response of mothers to increasing apparatus resistance - Davies J.M., Hogg M.I.J. and Rosen M. - Dept. Anaesth., Univ. Hosp. Wales, Heath Park, Cardiff - BRIT.J.ANÆSTH. 1974 46/2 (136-144)

In 37 mothers at the end of the first stage of labor, the effects were studied of deliberately increasing the inspiratory resistance of 2 types of inhalation apparatus, the Entonox apparatus and the Cardiff Penthrane Inhaler. The additional resistance consisted of 1 of 4 circular metal discs with a central hole of diameter varying from 5 mm to 9.5 mm. No mother rejected the apparatus when any of the resistances was added. Only on direct questioning did a small proportion of those who breathed through the higher resistances admit that they noticed any difference. The apparatus with the lowest resistance (9.5 mm orifice) satisfied all the physiological parameters studied. Changes in intrathoracic pressure were small and there was no significant effect upon frequency of breathing, mean ventilation, or peak flow. Mean ventilation was significantly reduced only when the highest resistance was added. It would seem that the Entonox apparatus and the Cardiff Penthrane Inhaler, even with added resistance, would satisfy the mothers and be acceptable physiologically. There is therefore no evidence that the resistance of the present

inhalation apparatus is excessive.

3572. Development of an electronic nebulizer humidifier - Curtis J.L. - Aerospace Med. Div., USAF Sch. Aerospace Med., Brooks AFB, San Antonio, Tex. 78235 - AEROMED.REP. 1974 No.SAM TR 74-8(5p.)

The Electronic Nebulizer Humidifier was designed to provide medical equipment capable of administering therapeutic humidification to patients in aeromedical aircraft. Specifications required the item to be compact, portable, lightweight, durable, and operationally compatible with both dedicated aircraft such as the C 9 and multimission aircraft such as the C 130 and C 141. In the airborne environment the unit must be capable of producing fine mist droplets (0.5 to 8 microns in diameter) to humidify and deliver moisture to the upper and lower pulmonary airways. The volume of water, as aerosol, delivered must be adjustable within a range of .5 to 3.5 ml per minute. The nebulizer humidifier must be easily secured to the poles of the standard (NATO) litter and be capable of providing aerosol therapy via an open face mask, face tent, tracheostomy mask, or high humidity tent. The evaluation indicated the Mistogen Electronic Nebulizer, Model EN153A, fulfills these requirements and is acceptable for use on USAF aeromedical aircraft.

3573. Application of the mathematical model of Bayes in the differential diagnosis of solitary pulmonary lesions (Polish) - Pietraszkiewicz L. - Zakł. Radiol. Osradka Walki Gruzlica Poznan - POZNAN.TOWARZ.PRZYJACIOL. NAUK 1973 Vol 45 (203-232)

On the basis of 263 cases of solitary pulmonary lesions, the matrix of symptom disease probabilities was elaborated for 8 diseases: tuberculoma, hamartoma, 3 histological types of bronchial carcinoma, lung abscess, chronic pneumonia and lung infarction. Twenty four radiological signs classified into 99 categories were subsequently reduced to 9 signs, classified into 19 categories. The probability matrix was combined with the probabilities estimated by Templeton et al. on the basis of 242 solitary pulmonary lesions. Probabilities of diagnosis were calculated using the mathematical model of Bayes and a Minsk 22 computer for the following differential problems: 8 diseases, 4 groups of diseases and 2 groups of diseases. The result was better when signs classified into many categories were reduced. When 8 diseases were diagnosed on this and the combined matrix, percentage of correct diagnosis was low, 47.1% and 47.6%. Overall accuracy of diagnosis for 4 groups of diseases was increased when this matrix and the combined one were used: 73.4% and 76.7% respectively. Similar results were obtained when differentiation between the group of non malignant and the group of malignant lesions was made (77.1% and 74.4%). Percentages of correct diagnosis obtained by an experienced radiologist were not significantly different from those of the computer: 84.6% and 79.2%, respectively. Selection of the most suitable radiological signs according to their discriminative weights are proposed as a possible way of improving the method.

3574. Use of a new controllable tip brush with the flexible fiber bronchoscope - Sanderson D.R. and Fontana R.S. - Mayo Clin., Rochester, Minn. 55901 - CHEST 1974 65/6 (620-621)

A new controllable tip flexible wire spring with disposable brush has proved useful in supplementing visual inspection during diagnostic flexible bronchofiberscopy and in securing samples from the bronchial tree for histologic, cytologic, and microbiologic study.

3575. The Bird Mark 8 respirator - LE RESPIRATEUR BIRD MARK 8 - Gueveler C. - Serv. Reanim. Urgences, Cent. Hosp. Reg., Orleans - AGRESSOLOGIE 1974 15/B (7-13)

The Bird Mk 8 respirator, a pressure release model, draws its energy solely from the gases which power it (additional external air can be added optionally by a Venturi system). The adjustable parameters are the maximum insufflatory pressure and the amount of gas taken in (insufflation rate). The apparatus can be used in assisted ventilation or in controlled (automatic) ventilation. It is solid, easily transported, effective in ventilatory physiotherapy and easy to maintain and service. As in all pressure release type respirators, the volume diminishes as the peripheral resistance increases. Thus a long apprenticeship is often required for maximum effectiveness and security.

3576. The Monnal S respirator - LE RESPIRATEUR MONNAL S - Gertner J. - Serv. Reanim., Hop. Internat., Univ., Paris - AGRESSOLOGIE 1974 15/B (51-58)

The Monnal S respirator is a fixed frequency model with a flow sectionalizer. It is unique in that it has a self regulating valve which ensures reliability and a mixing cock which ensures constant stability of the gaseous mixture whatever the flow rate, pressure and frequency. Its small dimensions and simplicity of operation make it useful for emergency cases and basic ventilation.

3577. The 03 N Logic respirator - LE RESPIRATEUR LOGIC 03 N - Ivanoff S. - Hop. Necker, Paris - AGRESSOLOGIE 1974 15/B (59-63)

The Logic 03 N respirator, designed for use with infants, has an enclosure in which a predetermined volume of a dosed mixture of air and oxygen is drawn in and expelled by a blower. The gas and the main source of energy are both provided by pressurized oxygen. Frequency is regulated by a Logic 03 apparatus. This is the only respirator of its kind in this particular volume and frequency range; it has additional residual positive pressure and thus would seem well suited for emergency situations requiring infants to be transported since it can mix a predetermined quantity of external air to the oxygen.

3578. The 661 Spiromat respirator - LE RESPIRATEUR SPIROMAT 661 - Giroud M.M. - Hop. Necker, Paris - AGRESSOLOGIE 1974 15/B (65-72)

The 661 Spiromat insufflates gas into the patient's lungs from a bellows. This is moved by a turbine powered by an electric motor. The power applied to the bellows is controlled

electronically (by a timing device) at a fixed ventilatory frequency.

3579. Shifts of the pulmonary recoil pressure volume curves - Clement J., Stanesco D.C. and Van De Woestijne K.P. - Lab. Longfunkt. Onderz., Acad. Ziekenh. St Rafael, Leuven - J.BIOMECH. 1974 7/3 (217-223)

When successive pulmonary recoil pressure volume (Pst V) curves are recorded during an experimental run, one or more of these curves may appear to be shifted in toto, either along the volume or the pressure axis, with respect to the other curves. A statistical technique is described which corrects for these shifts. The technique allows for the construction of a mean, unbiased, Pst V curve and for an evaluation an evaluation of the size of the ΔV , ΔPst shifts. The ΔV shifts result probably from variations in top inspiratory level. This error is not reduced by determining a total lung capacity value for each Pst V curve. The ΔPst shifts may be due to a temporary retention of air in the esophagus along the balloon.

6.9. Reproductive system

3580. The development of a hydrostatic compensating dual system for accurate intrauterine pressure determination - Rodrigues Lima J., Barbosa Montenegro C.A., Bernardes Panerai R. and De Rezende J. - Matern. Esc., Fed. Univ., Rio de Janeiro - AMER.J.OBSTET.GYNEC. 1974 118/8 (1143-1145)

The determination of intrauterine resting pressure by conventional hydraulic transmission methods, generally used in clinical and investigation studies, can be significantly altered by artifacts. Inaccurate leveling and unobserved altimetric variations of the uterus frequently occur and must be constantly watched for and corrected. A hydrostatic pressure free system was devised based on the subsequent philosophy: If two identical membrane transducers are leveled and communicate through a hydraulic system with an open container and the container's liquid surface is leveled with the transducers membranes, the readout is 0 in both preamplifiers. If the container is lowered or elevated, a negative or positive hydrostatic pressure will develop and the preamplifiers will give identical readings different from 0. If the two preamplifiers are connected to a differential amplifier, the resultant will be always 0 despite hydrostatic pressures.

3581. Construction and properties of hydrogel graft coated copper bearing intrauterine devices for rabbits - Scott H., Kronick P.L., May R.C. et al. - Coll. Engin., Div. Interdisciplin. Stud., Clemson Univ., Clemson, S.C. 29631 - BIOMAT.MED.DEV.ARTIF.ORGANS 1973 1/4 (681-702)

An active vapor grafting technique was developed for covalent attachment of biocompatible water swellable hydrogel coatings to plastic and elastomeric medical devices. This report describes its applicability in constructing durable and efficacious hydrogel graft coated

copper bearing polyethylene IUDs which are tolerated better in rabbits than uncoated IUDs. The in utero copper release properties and scanning electron microscopy examinations of related copper corrosion phenomena are also described.

6.10. Urinary tract

3582. Experimental studies on electrical stimulation of the bladder - Pagano F., Petracco S., Anselmo G. et al. - Dept. Urol., Univ. Padua - UROLOG. INT. (Basel) 1974 29/4 (291-298)

The authors describe a technique for electrical stimulation of the dog bladder and the results obtained after two experimental phases. They obtained the best results with stimulation by four electrodes. Pacemaker and electrodes remained in situ for 1 year without any complications.

3583. New cryotherapeutic probe with exchangeable optic system for the transurethral treatment of vesical tumors - NEUE KRYO THERAPIE SONDE MIT AUSWECHSELBARER OPTIK ZUR TRANSURETHRALEN BEHANDLUNG VON HARNBLASENTUMOREN - Steffens L. and Vahlensieck W. - Urol. Klin., St. Antonius Hosp. Eschweiler - UROLOGE AUSGA 1974 13/3 (119-121)

A cryoprobe designed for transurethral introduction and featuring an exchangeable optic system and a mechanical flushing device for the purpose of cryotherapeutic intervention within the bladder is presented. A detailed description is offered of the mode of operation of the instrument.

3584. Dialysis membranes: cellulose acetate compared with other available membrane materials - Miller J.H., Shinaberger J.H. and Martin F.E. - Chron. Dialysis Unit, Wadsworth VA Hosp. Cent., Los Angeles, Calif. - MED. INSTRUMENT. 1974 8/3 (214-217)

Compared to the usual cellulose hemodialysis membranes, those made from cellulose acetate are asymmetrical and possess up to 4 times greater permeability to water and to molecules in the 200 to 5,000 mol wt range. In clinical use, some of this advantage is lost because of dialyzer configuration. Because of the increasing proportional importance of the membrane in the mass transfer of larger molecules, however, enough of the cellulose acetate advantage remains to be of significant benefit in light of the 'square meter hour' hypothesis and permits more adequate dialysis and/or dialyses of briefer duration, smaller membrane area, blood, or dialysate flow. Studies also indicate that cellulose acetate is less likely to develop leaks in use than is Cuprophane. The ultrafiltration rate when using cellulose acetate was considerably more predictable ($r=.8$ to $.9$) than when Cuprophane was used.

3585. Fluorescence cystoscope assembly. A unit newly designed for biopsy on the bladder mucosa - Mitani G., Yokogawa M., Yamada T. et al. - Dept. Urol., Sch. Med., Tokyo Med. Dent. Univ.,

Tokyo - BULL. TOKYO MED. DENT. UNIV. 1974 21/1 (1-6)

The authors have newly devised a fluorescence cystoscope assembly. This fluorescence assembly is able to confirm lesions in the bladder mucosa by fluorescence, mark and cut the lesions with accuracy for histological survey. Moreover, this assembly is characterized by its exactness in cutting out the appropriate amount of specimen (bladder mucosa) and by its convenience in performing biopsy especially around the bladder neck.

3586. Hemodialyzer reuse: Estimation of area loss from clearance data - Farrell P.C., Eschbach J.W., Vizzo J.E. and Babb A.L. - Dept. Chem. Engin., Univ. Washington, Seattle, Wash. - KIDNEY INT. 1974 5/6 (446-450)

A procedure is described for estimating the loss in effective membrane area of a dialyzer during repeated reuse. The technique involves the accurate measurement of dialyzer clearance both before and after reuse. Either large or small molecule clearance can be used to estimate the area loss and clearances can be determined either in vivo or in vitro following the dialysis. Excellent agreement has been obtained between theoretical estimates of fiber bundle loss in hollow fiber artificial kidneys (based on clearance data) and values determined by saline rinse techniques. It should be possible to extend this theoretical procedure to flat plate dialyzers for which there is no analogous procedure to fiber bundle loss for determining loss in effective membrane area with repeated reuse. Extension of the procedure to determine area losses for coil dialyzers is not recommended.

6.11. Nervous system

3587. An automatic food dispenser for the study of alimentary behavior of pigs - UN DISTRIBUTEUR AUTOMATIQUE DE NOURRITURE POUR L'ETUDE DU COMPORTEMENT ALIMENTAIRE DU PORC - Hachet T. - Inst. Nat. Rech. Agron., Lab. Pharmacol. Toxicol., Toulouse - PHYSIOL. BEHAV. 1974 12/3 (515-517)

A programmable automatic dispenser of powdered or granular food for use in studies of alimentary behavior of pigs is described.

3588. Calculation of the electromyographic jitter - Ekstedt J., Nilsson G. and Stalberg E. - Dept. Neurol., Univ. Uppsala - J. NEUROL. NEUROSURG. PSYCHIAT. 1974 37/5 (526-539)

The electromyographic jitter is the variability at consecutive discharges in the time interval between two action potentials from two muscle fibres from the same motor unit. This paper deals with different methods of expressing the jitter. The method of choice seems to be Mean Consecutive Difference (MCD). $MCD = [(D_1 - D_2) + (D_2 - D_3) + \dots + (D_{n-1} - D_n)] / (n-1)$ where D_1, D_2 etc. are the individual time interval measurement data and n the number of discharges, preferably 50 or, if the jitter is not changing, 200. MCD can also be estimated from other measures of the jitter like Mean Range of Two (MR_2) (giving the same estimated value as MCD), Mean Range of Five (MR_5), Mean Range of Ten (MR_{10}) and also from

the Standard Deviation (SD). In a distribution without trends the following relations hold: $MCD=1.13 \times SD$, $MCD=0.49 \times MR_{90}$, and $MCD=0.37 \times MR_{100}$. The presence of slow variations and trends in most recordings makes SD not well suited for calculation because of the risk of getting too high estimates of the jitter.

3589. An application of the cross correlation coefficient to pattern recognition of honey bees - Cruse H. - Fachbereich Biol., Univ. Trier Kaiserslautern - *KYBERNETIK* 1974 15/2 (73-84)

In training experiments with honey bees, the discrimination of 6 pointed stars of different form and contrast is measured. The following assumptions allow a quantitative description of these results. The bee computes the two dimensional cross correlation coefficient $r(xy)$ between the two shapes to be discriminated (the rewarded shape and the one seen at present). This presupposes that the rewarded shape is stored in the memory point by point. In addition to the cross correlation coefficient, the shapes are discriminated by means of their contour length and their contrast. A noise is superimposed on the values stored in the memory. Because of this noise, the accuracy of detecting the outline of the stored shape depends on the value of the contrast. The lower the contrast the less accurately is the outline detectable. The exactness of the stored value of the contrast itself is also diminished by the noise. Although the results of these and of most previously published experiments can be described quantitatively by this model, some other results can certainly not be described in this way. In such cases, it seems more probable that bees use abstract parameters to discriminate the shapes because of the particular experimental method.

3590. A very stable electrode system for recording human scalp potentials with direct coupled amplifiers - Girtan D.G. and Kamiya J. - Langley Porter Neuropsychiat. Inst., Univ. California, San Francisco, Calif. 94143 - *ELECTROENCEPHALIN. NEUROPHYSIOL.* 1974 37/1 (85-88)

Electrochemical factors involved in DC recordings are presented. Described is an electrode system which uses long flexible tubes to separate the metal electrolyte interface of an electrode from the electrolyte skin interface. Using commercially available Ag/AgCl skin potential electrodes, the system gave less than 0.5 $\mu V/hr$ drift occurring at each metal electrolyte interface. The stability of the electrode bias potential is unaffected by connecting the bridge tubes to the subject or by other disturbances that occur during recording. In 1 hr recordings from 4 subjects, the total measured potential changed at an average rate of 9 $\mu V/min$, a 5 fold improvement over previously described electrodes.

3591. Stereotaxic topography of the brain of the quail (*Coturnix coturnix japonica*) - Bayle J.D., Ramade F. and Oliver J. - Lab. Physiol. Gen., Univ. Montpellier - *J. PHYSIOL. (Paris) oliguria* 1974 68/2 (219-241)

Semi diagrammatic plates of the quails brain in stereotaxic coordinates are proposed as a tool for workers who are interested in the quail

as an experimental animal. A stereotaxic instrument is described which is easily made suitable for experiments on the quail, provided the ear bars and the beak holder are modified. Drawings from sections of 150 birds were superimposed in order to provide outlines of the brain and the histological location of deep nervous structures. Sagittal planes were presented at 0.1, 0.3, 0.5, 1.0, 2.0 and 3.0 mm from the midsagittal section. Transverse planes were shown at 0.0, 2.0, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0 and 8.0 mm anterior to the interaural axis. The terminology used is that of Ariens Kappers et al. (1936). More than 300 birds used in various experiments attested to the accuracy of the method.

3592. External program control of a laboratory computer to obtain representative criteria for average evoked potentials - EXTERNE

PROGRAMMSTEUERUNG EINES LABORCOMPUTERS ZUR GEWINNUNG REPRESENTATIVER MERKMALE FÜR AVERAGE EVOKED POTENTIALS - Gurk C., Baumann H. and Schauer M. - Zent. Inst. Herz Kreislauf Regulat. Forsch., Akad. Wissensch. DDR, Berlin Buch - *ACTA BIOL. MED. GERM.* 1973 31/6 (853-861)

The algorithm and technical implementation of external control of an average computer are described, permitting one to combine the process of averaging evoked potentials and the derivation of representative criteria for these average evoked potentials (AEP). By virtue of its programmed control of address advance, the system intervenes in the computers own principle of fixed adjustment of the time interval represented by each address value. This minimizes the address demand for obtaining criteria so that processing can be made by all 4 channels of the computer (storage capacity 400 addresses). Furthermore, the averaged pre analysis interval may be stored for each AEP. To demonstrate the mechanism of external control, its integration into the experimental unit of the neurophysiological test process is described.

3593. Behavioral audiometry in adult chinchillas - Eddy L.B., Morgan R.J., Kirol M.K. et al. - Dept. Physiol. Biophys., Colorado State Univ., Fort Collins, Colo. 80521 - *BIOMED. SCI. INSTRUMENT.* 1974 Vol.10 (173-178)

Recent studies indicate the audibility curve of the chinchilla to be very similar to that of man. A group of ten adult chinchillas were tested in an attempt to compare the thresholds of binaural versus monaural animals. Extensive behavioral training was utilized. The training was performed with the animal in a sound treated, quiet room. The animals were placed in a wire mesh cage which was divided in half by a low barrier. The chinchillas were trained to respond to tones by jumping across the barrier. The tones were projected by an automatic sequencer in octave steps from 250 to 8000 Hz. Once the animal performed consistently on 80% or better of the trials, threshold data were collected at each frequency. After establishing the audibility curves of the binaural chinchillas, sterile surgery was performed to destroy the left cochlea of each animal. When recovery was complete the animals were retrained using the same procedures. Data

were then collected to determine the audibility curves of the monaural animals. This experiment indicates the chinchillas' audibility curve is decreased by a factor of approximately 10 decibels (db) on the average as a result of the surgical destruction of the left cochlea.

3594. Evolutionary learning circuits - Conrad M. - Inst. Informat. Sci., Univ. Tubingen - J.THEOR.BIOL. 1974 46/1 (167-188)

This paper presents a theory of the central nervous system (CNS) based on information processing concepts suitable for describing molecular biological systems. The main features of the theory are that the CNS consists of various types of unit regions of which there are many interchangeable replicas, and each region contains neurons whose firing is determined by excitase enzymes which recognize specific patterns of inputs and which may be coded by genes which are either heritable or culturable, and the CNS has selection circuits which test and evaluate individual regions and which control the production of culturable excitase genes on the basis of this evaluation. The genes whose production is stimulated diffuse out of the regions in which they are produced to transform other, competent regions of the same type. The function of the excitase molecules is the same in these new regions because the tissue structure and cellular properties are the same. This makes it possible for trial and error learning to be mediated by the same mechanisms as natural evolution, except that it is more efficient due to the selection circuits. Systems operating on the above basis are capable of performing any operation performable by a conventional computer, but with certain important restrictions on programmability. Such systems are also (structurally) simpler than conventional information processing devices and more amenable to learning and evolution. The theory makes a number of definite predictions about the CNS, some of which correspond to known facts and others of which are testable.

3595. A simple method for studying operant wheel running in rats - Porterfield A.L., Stern J.J. and Valade Jr W.B. - Dept. Psychol., Univ. Michigan, Dearborn, Mich. 48128 - PHYSIOL.BEHAV. 1974 12/6 (1083-1085)

The present report describes an operant running device for rats. The apparatus makes use of an activity wheel driven by a small electric motor. The motor is started by a bar press; once activated, the wheel turns for 3-30 sec depending on the setting of a timing device. The system is well suited to long term studies of activity patterns.

3596. System for controlling and monitoring conditioned motor activity - DISPOSITIF POUR LE CONTROLE D'UNE SEQUENCE MOTRICE CONDITIONNEE - Bakalian L. and Tardy M.F. - Lab. Psychophysiol., Univ. Provence Cent. St Jerome, Marseille - PHYSIOL.BEHAV. 1974 12/6 (1091-1096)

An instrumental apparatus used to train animals is described. It allows programming of various tasks and monitoring of the ensuing events. The different signals can be visualized

and recorded on paper tape or sent out to data processing systems. The apparatus also permits programming of electrical stimulations and monitoring of the resulting effects.

3597. A physiological control theory of food intake in the rat: mark 1 - Booth D.A. and Toates F.M. - Univ. Birmingham - BULL.PSYCHONOMIC SOC. 1974 3/6 (442-444)

The theory that current supply of readily used energy is the primary control in feeding is embodied in a computer model of energy flows from the gut and to or from storage as fat. Values for all parameters are derived from physiological data. Meal patterns and cumulative food intakes are realistically predicted for normal and ventromedial hypothalamus lesioned rats.

3598. An effective drinking device for cats - Sturgeon R.D., Brophy P.D. and Levitt R.A. - Tennessee A.&I. State Univ., Nashville, Tenn. 37203 - BULL.PSYCHONOMIC SOC. 1974 3/5B (393-394)

Several designs for water delivery devices were tested in comparison with the water dish. The most satisfactory device proved to be a Kimax tube originally designed for use with rats. The original tube was modified with a glassblower. To facilitate filling and cleaning the tube, a hole was constructed in the top into which a No. 3 rubber stopper was fitted. The spout of the original tube was replaced by one of larger diameter, and a small drinking cup was fashioned into the end of this spout. The cup had a diameter of approximately 32 mm at the top due to flaring, but about 25 mm at the water level. The tube was fastened to the front of the cage with clamps and a stainless steel water bottle spring could be added for additional security. The tube is calibrated in 1 ml intervals allowing for much greater accuracy while measuring water consumption, and readings may be obtained at any time interval without disturbing the animals' drinking bout.

6.12. Receptors

3599. A technique for the determination of chemical binding to soft contact lenses - Sibley M.J. and Yung G. - Barnes Hind Pharmaceut., Inc., Sunnyvale, Calif. - AMER.J.OPTOM. 1973 50/9 (710-714)

A technique for the determination of chemical binding was developed which provides a convenient tool to investigate the nature of chemical agent soft contact lens interaction. Results show benzalkonium chloride binds but thimerosal does not bind to Bausch and Lomb and Warner Lambert soft contact lenses.

3600. The new recording of words for testing hearing with speech - DIE NEUAUFNAHME DER WORTER FUR GEHORPRUFUNG MIT SPRACHE - Brinkmann K. - Phys. Techn. Bundesanst., Braunschweig - ZHOERGERAKUST. 1974 13/1 (12-40)

The speech intelligibility reference curves for the new recording of Words for Testing Hearing with Speech were determined in the Physikalisch Technische Bundesanstalt (PTB) with

the aid of a large number of normal hearing persons. The results of these tests are described. A method for the objective calibration of speech audiometers is described and the present state of German standardization in the field of speech audiometry is presented.

3601. Evidence for mechanical origin of peripheral inhibition in the anuran inner ear - Capranica R.R. and Moffat A.J.M. - Sect. Neurobiol. Behav., Cornell Univ., Ithaca, N.Y. 14850 - J.ACOUSTICAL SOC.AMER. 1974 55/sup. (s85)

The auditory fibers in the eighth nerve of the American toad (*Bufo americanus*) that have their best excitatory frequencies in the range 100-600 Hz can be totally inhibited by the addition of a second tone of appropriate frequency and intensity. Each of these fibers can also be excited by a pair of tones if their frequency difference is approximately equal to the units best excitatory frequency, even though neither tone by itself has any excitatory effect on the unit. The intensities of the two difference tones in many cases need only be 10-20 dB greater than the intensity of the best excitatory tone to evoke comparable spike rates. The excitation of these low frequency fibers by difference tones seems to reside in nonlinear mechanical events in the inner ear. Midfrequency sensitive units, having their best frequencies in the range 500-1000 Hz, and the high frequency sensitive units, with their best frequencies in the range 1100-1700 Hz, cannot be inhibited by tones nor can they be excited by pairs of difference tones. Similar results in other anuran species provide evidence that inhibition in the peripheral auditory system of frogs and toads is of mechanical origin.

3602. Some thoughts on the psychology of the hard of hearing - Kluger H.A. - Z.HORGERAKUST. 1974 13/3 (104-112)

An attempt is made to show that the basic psychological situation of a hard of hearing person is dependent upon his age and the duration or the point of occurrence of the impairment. The phase of evolution in the young child, the integration in schoolchildren, stabilization in adulthood and involution in the old person are considered.

3603. A new technique for objectively plotting visual fields - Jernigan M.E. - Biometr., Inc., 243 Binney St., Cambridge, Mass. 02142 - ANN.OPHTHAL. 1974 6/4 (335-341)

By utilizing photoelectric eye movement monitoring techniques, in conjunction with a programmed target projector, it is possible to obtain automatic, relatively objective visual field plots. The eye movement monitor signals are processed electronically to automatically decide whether a given target was seen or missed by the subject. Aspects of the electronic decision algorithm are discussed. Field plots are recorded on Polaroid film and, in addition, the subjects' eye movement responses are recorded by a strip chart recorder for more detailed analysis if desired. Sample plots and eye movement recordings are shown. Successful operation of a breadboard instrument demonstrated the capability of testing even difficult patients by

minimally trained operators.

3604. The noise dosimeter - Toremalm N.G. and Lagerholm S. - ENT Dept., Univ. Lund Gen. Hosp., Malmö - SCAND.AUDIOL. 1974 3/1 (3-9)

Noise induced hearing loss is a constantly growing problem. Prophylactic measures have until now been based on exact measurements of the intensity and frequency of local noise sources. However, the duration of exposure has only been roughly estimated, especially in cases of varying or intermittent types of noise. In order to integrate intensity and duration of exposure more exactly, a pocket sized apparatus - the individual noise dosimeter - has been developed. It is described in detail in this article, together with some basic function tests. The practical utilization of the dosimeter will permit the following advances in noise prophylaxis: the daily use of dosimeters will increase the motivation for the use of individual noise protection; general measures for noise reduction can be enforced more quickly and effectively if they are guided by weekly individual noise dose recordings; and long term studies with dosimeters and hearing tests are expected to assist in establishing risk criteria for noise induced hearing loss.

3605. Derivation of a quantitative kinetic model for a visual pigment from observations of early receptor potential - Mink B., Hochstein S. and Hillman P. - Inst. Life Sci., Hebrew Univ., Jerusalem - BIOPHYS.J. 1974 14/6 (490-512)

A 'complete' and quantitative kinetic model for the states and transitions of the barnacle visual pigment *in situ* was constructed from intracellular recordings of the early receptor potential responses to long light pulses. The model involves two stable and four thermolabile states and 10 photochemical, thermal, and metabolic transitions among them. The existence of each state and transition is demonstrated by qualitative examination of the response resulting from a carefully chosen experimental paradigm (combination of intensity, duration, and wavelength of adaptation and stimulation). Quantitative examination of the same responses determines all of the model transition rates, but only puts constraints on the state dipole moments. The latter are determined, and the former refined, by quantitative comparison of the predictions of the complete model with the responses to a set of paradigms chosen to involve as many states and transitions as possible. The fact that good fits can be obtained to these responses without further modification of the model supports its completeness.

3606. Mechanical properties of muscle spindles in *Xenopus laevis* - Smith R.S. and Koles Z.J. - Neurophysiol. Lab., Dept. Surg., Univ. Alberta, Edmonton - KYBERNETIK 1974 15/2 (91-98)

Mechanical properties of isolated living muscle spindles from *Xenopus laevis* were examined in order to determine their role in sensory transduction. The reticular zone of the intrafusal muscle fibers was identified microscopically by: its position beneath the sensory endings, its length, 50-100 μm , its extension during intrafusal muscle contraction,

and its coarse striations with a period of about 1.5 times the normal sarcomere length. The reticular zone in the passive muscle spindle did not extend until the spindle was stretched to about 1.05-1.1 its maximal length in the animal (Lm). Evidence was obtained that the absence of extension of the reticular zone at normal muscle lengths was due to the presence of the spindle capsule which acted as a stiff element in parallel with the sensory region. At those lengths at which the reticular zone did extend ($>L_m$), no rate/sensitive mechanical properties were detected in response to step and ramp extensions. The sensory discharge of the spindle showed no dynamic transient in response to ramp extensions if the reticular zone were not extended. During extension of the reticular zone a dynamic sensory transient appeared. It is concluded that current notions on the mechanical origin of the rate/sensitive properties of the sensory discharge of the muscle spindle do not apply to *Xenopus laevis*. In addition, it is not likely that the passive spindle in this animal is a sensitive stretch receptor.

3607. Characteristics of the sensory discharge of the muscle spindle in *Xenopus laevis* - Koles Z.J. and Smith R.S. - Neurophysiol. Lab., Dept. Surg., Univ. Alberta, Edmonton - KYBERNETIK 1974 15/2 (99-110)

Single isolated muscle spindles from the toad *Xenopus laevis* were studied with regard to their response to different levels of steady stretch and to their response to small precisely controlled length variations. The spectral distribution of the applied variations was designed to be essentially uniform in the region between 0.04 Hz and a number of selectable upper limits none exceeding 20 Hz. The results obtained relate to the statistics of receptor discharge intervals, to receptor transfer functions and to the coding and decoding of sensory information. The conclusion is that spectral analysis techniques can be used to clarify many aspects of muscle spindle behavior.

3608. Gain controls and adjustment of amplification in hearing aids - De Boer B. - ZHORGERAKUST. 1974 13/4 (118-139)

The acoustical gain provided by a hearing aid is adjusted with the aid of rotary potentiometers, rheostats, trimming potentiometers and trimming resistors. These control elements consist in principle of a non conductive carrier, bearing, between 2 fixed terminals, a resistance layer which can be scanned by a moving contact. The manner in which control is effected depends closely on certain electrical properties of the resistance layer. A description of the general mechanical structure and the composition of the resistance layer, certain characteristic properties of the control elements, such as resistance curve, residual resistances and contact resistance, and the influence of these on the amplification are discussed at length.

3609. Apparatus for electrocochleography - Spoor A. - Dept. ORL, Univ. Med. Cent., Leiden - ACTA OTO-LARYNG. (Stockh.) 1974 77/316 sup (25-36)

The principle of enhancement of a weak

biological signal from background noise by an average response computer is elucidated, with indication of the limitations. The frequency content of the effective tone burst sound stimulus was calculated to estimate the frequency specificity of the stimulus. A description is also given of the signal switching circuitry used to make separate recordings of CM and AP simultaneously. Some details are given of a circuit permitting rapid determination of AP threshold values and input output curves with tone bursts. Because the apparatus was developed to be applicable for experimental work and for auditory evoked response audiometry, several special features were incorporated. A circuit for accurate measurement of latency, a double synchronized tone burst generator, and a dB linear intensity ramp with FM bursts are briefly described. A flexible trigger generator provides many trigger modes for single tone burst and pulse train stimulation. These stimuli can be used with various interstimulus and interseries intervals. Continuous and forward masking experiments with tones or noises can be performed. The tone burst shape can be varied within wide limits.

3610. Model of the processing of signals in neuronal ensembles as exemplified by the glomerulus of the lateral geniculate body of the visual system - Dudkin K.N. and Gauzelman V.Y. - Pavlov Inst. Physiol., USSR Acad. Scis, Leningrad - BIOPHYSICS (Oxford) 1973 18/4 (764-773)

A model of the neuronal ensemble, the structural basis of which is the morphological scheme of the glomerulus of the lateral geniculate body (LGB) is investigated. It is shown that the behavior of such an ensemble is described by a set of non linear differential equations. It is established that the initial peak with the subsequent fall that is characteristic of transitional processes of the responses of the neurons of the LGB is determined by the negative feedback through an internuncial neuron. The value of the coefficient of the feedback determines the rate of rise, the height of the initial peak and the depth of the fall. The efferent excitatory signals increase the rate of rise and the height of the initial peak. The model possesses properties reproducing the dynamics of the antagonistic and synergic lateral inhibition in the receptive fields of the LGB; the transitional processes of the responses of the neurons substantially differ: in the case of the antagonistic inhibition, the start of the response is inhibited and in the case of the synergic, the end.

3611. Clinical evaluation of behind the ear hearing aids with compression amplification - Blegvad B. - State Hearing Cent., Univ. Hosp., Odense - SCANDAUDIOL. 1974 3/2 (57-60)

A total of 42 selected patients with hearing impairment of purely perceptive type and with definite recruitment by Metz's test compared a behind the ear hearing aid with amplitude compression amplification and a behind the ear hearing aid with linear amplification over a trial period of at least 2 mth, the instruments being tested by alternating use. Not quite one third of

those studied (13 patients) chose the compression amplifier hearing aid, while the remainder preferred the conventional amplifier. The subjective evaluation revealed only minor differences between the 2 types of apparatus. Neither a determination of the dynamic range of the ear by measuring the sensation level of the acoustically elicited middle ear muscle reflex, nor a determination of the dynamic range for intelligible speech on the speech audiogram, appears to be suited to predicting which patients should have treatment by means of compression amplification.

3612. The effect of the curvature of the eye shell on the echogram - Oksala A. and Fraenkl G. - Ophth. Dept., Univ. Hosp., Turku - ACTA OPHTHAL. (Kbh.) 1974 52/3 (334-341)

When sensitive ultrasonic equipment is used, both clinical and experimental examinations reveal one or more low echoes in front of the high rear wall echoes, if the sound beam is directed perpendicularly to the rear wall past the lens. In the experimental part of the study 7.5 MHz/2 mm, 6 MHz/5 mm and 6 MHz/8 mm transducers were used for the purpose of finding out the origin of these low echoes in pig eyes. The results showed that these low echoes were due to the difference in distances between the central and marginal parts of the sound beam caused by the curvature of the eye shell. Similar low echoes could be produced at clinical examinations at frequencies of 6 MHz and 10 MHz. The low echoes disappeared when the amplification of the equipment was lowered from 80 db to 72 db. Acoustic answers of low reflecting agents, as slight dense and flat preretinal exudates or hemorrhages cannot, therefore, be distinguished from these findings.

3613. A slit lamp accessory for simple documentation of anterior segment findings - SPALTLEMPENZUSATZ ZUR EINFACHEN DOKUMENTATION VON VORDERABSCHNITTSBEFUNDEN - Kilp H. - Univ. Augenklin., Köln - KLIN.MBL.AUGENHEILK. 1974 164/6 (827-828)

The author describes a simple piece of accessory equipment which permits a quick and exact documentation of findings of changes of the anterior segment.

3614. Image converter pattern tracker for variable retinal feedback experiments - Palmieri G., Scotto M. and Oliva G.A. - Lab. Cibernet. Biofis. Cons. Naz. Ric., Camogli, Genova - KYBERNETIK 1974 15/4 (193-202)

An optoelectronic device able to change the gain of the retinal feedback path from its natural value (-1) to any other value in the range -5, +5 is presented. The employment of an image converter tube with coupled magnetic deflection circuit allows a large variety of targets to be used. Any type of artificial movements, moreover, can be imposed to the target itself. The device can be driven by any eye movement detector able to transduce the horizontal and vertical components of the eye rotation in the form of electrical signals. Experiments were performed to investigate the effects of varying the gain of the retinal feedback loop on the eye behaviour.

Evidence was found for the existence of a range of values of such gain where the eye goes into spontaneous smooth sinusoidal like oscillations. This phenomenon was examined with the control theory methods in terms of stability of the pursuit system. A correlation between the spontaneous oscillations and the well known learning capability of the visual system was found.

6.13. Locomotor apparatus

3615. Instrument for isotope determination in vivo of mineral content of the jaw bone - Bjork N., Eliasson S., Falk J.E. and Henrikson C.O. - Dept. Prosthet. Dent., Sch. Dent., Karolinska Inst., Stockholm - ACTA RADIOL.SER.DIAGN. 1974 15/2 (187-192)

A device for measurement of the bone mineral in the jaws is described. The transmission of a narrow beam of radiation from an isotope is measured. Windows applied to the mucosa on both sides of the object permit the determination of thickness to be made without disturbance from saliva or mobile tissue. Roentgenography of the region under examination is made possible and is a feature of the instrument.

3616. Sensory feedback in upper limb prosthetic systems - Rohland T.A. - Bio Engin. Inst., Univ. New Brunswick, Fredericton - INTER-CLIN.INFORM.BULL. 1974 13/9 (1-4)

The effectiveness of sensory feedback in giving the patient more control over his prosthesis was tested with two amputees. Formal tests were also performed with several normal subjects. They were asked to apply certain discrete pressures with the prosthetic hand to a pressure measuring device while not watching the pressure gage. They did this without feedback, with feedback, and with their own (normal) hands. The mean square error for the series with feedback was approximately 10 times smaller than that for the series without feedback, but 2 or 3 times larger than that for the series using the normal hand. Thus the feedback is seen to be measurably better in controlling a myoelectric prosthesis, although still not as good as human sensory feedback. The results of the tests indicate that a prosthesis is easier to control when sensory feedback is provided and that the proposed technique is acceptable to the people using it as well as professional people knowledgeable in this field. Therefore, it seems highly desirable to provide sensory feedback for myoelectric control systems. The next project to be undertaken in this respect will be to redesign the system to use less power while providing the same functions, miniaturize it, and incorporate it into a prosthesis for amputee testing under normal conditions.

3617. Characteristics of a transducer for tactile displays - Shannon G.F. - Dept. Electric. Engin., Univ. Queensland, St. Lucia - BIO-MED.ENGINEERING (Lond.) 1974 9/6 (247-249)

The need for feedback systems that convey

information about a prosthesis to the user's central nervous system is apparent. This article discusses the use of a tactile display in such a feedback system and goes on to describe a transducer for incorporation into such a system. The transducer utilizes a vibrating felt pad and is controlled by a modulated signal. Initial results are presented.

3618. A study of the bone machining process: orthogonal cutting - Jacobs C.H., Pope M.H., Berry J.T. and Hoaglund F. - Univ. Vermont, Burlington, Vt. 05401 - J.BIOMECH. 1974 7/2 (131-136)

There appears to be no record of any orthogonal cutting analysis of bone in the literature, although many surgical procedures using cutting tools are performed every day. This paper describes a series of two component cutting dynamometer experiments at constant speed using bovine bone as the workpiece for an orthogonal cutting analysis. The bone samples were taken from the mid diaphysis of bovine tibiae and were cut in three mutually perpendicular directions; across, parallel and transverse to the preferred osteon direction. Microscopic and scanning electron microscopy photographs are presented detailing the five different chip types categorized by the authors. Precutting (i.e. plastic deformation) studies were conducted and a theory for precutting behavior based on hydroxyapatite crystallite interlocking is postulated. The Merchant analysis of orthogonal cutting is shown to have limited applicability to bone material.

3619. Measurement and reduction of noise in kinematics of locomotion - Winter D.A., Grant Sidwall H. and Hobson D.A. - Shriners Hosp. Crippled Child., Winnipeg - J.BIOMECH. 1974 7/2 (157-159)

All kinematic studies utilize data obtained from some type of measurement and data reduction system, which inherently adds noise to the spatial signal. Although this noise may not be visibly evident in the spatial trajectories, it can cause large inaccuracies when velocities and accelerations are determined by direct differentiation. Therefore, some form of data treatment, such as filtering, must be developed to decrease the noise content. The design of such filters requires knowledge of the frequency spectrum of the signal and noise. Utilizing data obtained from a television tracking system a spectral analysis of the trajectories of 7 body markers in the sagittal plane, and of the knee angle as determined by 4 of these markers, was performed on 21 runs (8 subjects) of 2 or 3 strides each. Results indicate that, for the marker trajectories, 99.7% of the signal power lies below the 8th harmonic. For the knee angle, 99.7% of the signal power is contained below the 6th harmonic. Suitable low pass digital filtering reduces the higher frequency noise to such an extent that meaningful velocities and accelerations can be calculated by direct digital differentiation.

3620. Simple model of maintenance of equilibrium - Fomin S.V. and Shtilkind T.I. - Inst. Probl. Informat. Transm., USSR Acad. Scis,

Moscow - BIOPHYSICS (Oxford) 1973 18/4 (790-798)

An elementary model of maintenance of vertical posture of man is considered. Various modes of maintaining equilibrium of the model are discussed. Preference is given to the most simple algorithms of control using the minimum of input information.

3621. A photoelectronic device for recording of three dimensional positional changes and its application to analysis of human motion - Saito S., Yamanobe H. and Tsukahara S. - Dept. Physiol., Fukushima Med. Coll., Fukushima - TOHOKU J.EXPMED. 1974 113/1 (25-35)

A photoelectronic device for analysis of three dimensional motion of the human body without laborious frame by frame analysis of cine film records was constructed. The apparatus consists of three photoelectronic units including cylindrical lenses and photoelectronic elements. Each unit gives electrical output signals corresponding to X, Y and Z axis co ordinates of the target position, respectively. Functional dependence of the output of the unit on the position is linear. The measuring system enables to measure and record the displacements of human motion in any direction as well as velocity and acceleration components under both static and dynamic conditions.

3622. The effects of caudocephalad (+G_y) acceleration on the initially curved human spine - Liu Y.K. and Von Rosenberg D.U. - Biomech. Lab., Tulane Univ. Sch. Med. Engin., New Orleans, La. 70112 - COMPUT.BIOL.MED. 1974 4/1 (85-106)

A beam column model of the human spine subjected to a caudocephalad (+G_z) acceleration is analyzed by the finite difference numerical technique. It was shown that the previous analytical treatment of this problem by the assumed mode method is valid only for either very low levels of the acceleration pulse or for very early times in the response, i.e., the loading is such that the initial configuration of the spine is little changed by the dynamics. Numerical results generated, using a 20g step acceleration input, show that the initial configuration is so appreciably changed as to invalidate the results of the assumed mode analysis. Any future extensions of similar continuum models of the human spine, to include other additional effects, should treat the use of classical analysis with caution and consider the efficacy of computer aided numerical analysis by either the present finite difference solution or the currently popular finite element method.

6.14. Skin

3623. Effects of three modes of application of short wave diathermy on the cutaneous temperature of the legs - Valtonen E.J., Lilius H.G. and Svinhufvud U. - Dept. Phys. Med., Meilahti Hosp., Univ. Helsinki - EUROPA MEDICOPHYS. 1973 9/2 (49-52)

The reflex heating effect of short wave diathermy was studied. The two modes of application of the customary short wave

diathermy, the condenser technique and the application of the induction coil, were compared with the new method, the application of pulsed high frequency current (Diapulse). The last mentioned (Diapulse) caused the temperature of the legs to rise most effectively. Because the customary short wave diathermy has some disturbing side effects, the use of this athermic mode of treatment is to be recommended.

3624. Optical effects of pigmentation on temperature rise in a two layer skin simulant system during irradiation - Piergallini J.R. and Stoll A.M. - Crew Syst. Dept., Nav. Air Developm. Cent., Warminster, Pa. 18974 - AEROSPACE MED. 1974 45/5 (485-490)

It is demonstrated that, from a knowledge of the thermal and optical properties of each layer of a two layer system, together with the amplitude and distribution of the energy input, it is possible to predict temperature rises at depth in the second layer of a two layer system. By varying the optical properties of the first layer and observing the temperature rises at depth in the second layer, the experimental results can be used to verify mathematical expressions for optical and heat transfer processes of the two layers. Such a system was devised to determine the thermal conductivity of intact, living skin by measuring the interface temperature between a silicone rubber path and the living skin when irradiated. It may also be used in evaluations of other two layer systems where reflectance, transmittance, and heat transfer properties are known and must be accounted for in the mathematical model.

6.15. Aerospace medicine

3625. Aviator's breathing oxygen contaminant detector - Ikels K.G., Crow W.L. and Kilian H.J. - Aerospace Med. Div., USAF Sch. Aerospace Med., Brooks AFB, San Antonio, Tex. 78235 - AEROMED REP. 1974 No. SAM TR 74-2(10p)

The routine and special analysis of liquid aviator's breathing oxygen (ABO) is a problem faced by all Air Force operational flying bases. At present, there is no rapid base level analyzer system capable of establishing the quality of ABO. Samples must be shipped to off base laboratories for analysis which has the prime shortcomings of being slow, inconvenient, and does not determine the quality of ABO received by the pilot. A portable infrared system has been developed that can rapidly determine the quality of ABO at the base level in aircraft, service cart, or bulk supply. The analyzer system was specifically designed to analyze ABO at the point of delivery to the pilot.

6.16. Work and sport

3626. Utilization of a telemetric method for long distance recording of electrophysiological activity in man - UTILISATION DE LA TECHNIQUE TELEMETRIQUE POUR L'ENREGISTREMENT A LONGUE DISTANCE D'ACTIVITES

ELECTROPHYSIOLOGIQUES CHEZ L'HOMME - Gauthier P., Jouffray L., Rodi M. and Gottesmann C. - Lab. Psychophysiol., Fac. Sci. PCNI, Nice - C.R.SOC.BIOL. (Paris) 1973 167/8-9 (1185-1192)

Electrocardiogram data obtained by the use of telemetry confirmed literature results obtained in parachutists. Parachuting constitutes very unfavorable conditions for recording. The quality of electroencephalographic traces continuously obtained during the tests was satisfactory during the period when the aeroplane was gaining altitude and during the period when the parachute was open. During free fall the physical constraints and muscular activity strongly perturb the recordings. This technique of telemetry should find various applications in ergonometics, the surveillance of patients, and ethological research with animals of moderate size.

6.17. Radiology

3627. Transformation of ionization measurements to the absorbed dose in dosimetry of high energy beams of radiation - PREVOD IONIZACNIH MERENI NA ABSORBOVANOU DAVKU PRI DOZIMETRII VYSOKOENERGETICKYCH SVAZKU ZARENI - Rytina K. - Ust. Fyziky Plazmatu CSAV, Praha - CS.RADIOI. 1974 28/1 (61-68)

The problems of the transformation of dosimetric measurements by means of the ionization method to the dose absorbed at a defined site of the irradiated medium are reported. On the basis of the results of various studies, determining the spectral composition of primary and secondary electrons during their passage through the irradiated medium, the conversion factors for electron beams with energy up to 40 MeV are determined. Their dependence on the energy and depth in the water phantom, as also the example of the influence of this correction on the depth dose curve, are illustrated by means of several graphs.

3628. The dose distributions in fields of some Siemens cobalt units and their simulation by a mathematical model with a survey of its accuracy - Patomaki L.K. and Verho S. - Dept. Phys., Univ. Kuopio - STRAHLENTHERAPIE 1974 147/3 (231-241)

A general mathematical model was fitted to measured percentage dose distributions of two radiation therapy cobalt units. The accuracy of the model in describing the dose distributions in single fields was carefully studied and found adequate in dose planning. The model permits relative dose calculations for any arbitrary field size and any arbitrary source to skin distance (within the stated limits) at any point within the irradiated volume. The suitability of the model for computerized dose planning with mini computers is suggested.

3629. Adaptation of infant warmer for magnification radiography - Poznanski A.K., Borer R.C. and Roloff D.W. - Dept. Radiol., S. Mott Child. Hosp., Univ. Michigan Med. Cent., Ann Arbor, Mich. 48104 - RADIOLOGY 1974 112/1 (219-220)

A simple modification of a commercially available infant warmer allows magnification radiography of infants in an intensive care nursery.

3630. Dynamics of thin film thermal detectors in infrared imaging systems. I: Basic equations and Fourier analysis - Lab. Festkörperphys., ETH, Zurich - APPL.OPT. 1974 13/6 (1455-1459)

The complete Fourier analysis in space and time is performed for a three dimensional model of thin film thermal imaging systems. The model includes heat losses by thermal radiation and by heat conduction within the film as well as into the adjacent medium. Dirac δ functions are used for the description of the specific heat and the thermal conductivity. The exact solutions of the basic heat equation are applied for a comparison of different types of the Panicon, a passive thermal imaging device. The relevant temperature response is illustrated in the Fourier space. The inclusion of the adjacent medium implies an occasional maximum of the response function in k space.

6.18. Anesthesia

3631. Anaesthetic practice. Pollution in operating theatres - Bethune D.W. and Collis J.M. - Reg. Thorac. Cent., Papworth Hosp., Cambridge - BIO MED. ENGINEERING (Lond.) 1974 9/4 (157-159)

The pollution of operating theatres with anesthetic gases and vapours is discussed and consideration is given to the methods available for reducing the level of pollution.

3632. Hazardous and disturbing currents in electromedical installations; their measurement and counteractions - GEFAHRDENDE UND STORENDE STRÖME IN ELEKTROMEDIZINISCHEN ANLAGEN; MESSUNG UND GEGENMASSNAHMEN - Krestel E. - Geschäftsgebiet Elektromed. Techn., Siemens AG/UB Med, Erlangen - BIOMED. TECHN. 1974 19/3 (118-122)

In electromedical installations, non voluntary currents may flow via undesired coupling capacitances. These currents may be hazardous to the patient, the operator and others or may cause disturbances in measuring physiological variables. Current paths and circuits for the measurement of non voluntary currents are described and hints given concerning the reduction or prevention of such currents.

6.19. Monitoring

3633. A wireless respiration failure detection system - Pope J.M., Dimeff J. and Abraham S. - Nat. Aeronaut. Space Adm., Ames Res. Cent., Moffett Field, Calif. 94035 - MED. BIOL. ENGINEERING 1974 12/3 (348-354)

Respiratory failure for as little as 2 min can cause permanent brain damage or death by suffocation. Infants, small children or comatose adults who have had tracheal tubes surgically implanted are vulnerable to this problem, and

therefore require continuous surveillance. An apnea monitor consisting of a transmitter, an f.m. receiver and an alarm control unit has been developed that provides continuous, automatic monitoring of a patient's respiration. In the event that respiration fails completely or falls below preset limits, the system actuates an alarm so that immediate corrective action can be taken.

3634. A patient safety program for small hospitals - Chisholm L.A., Telder R. and Dolan A.M. - Dept. Technol. Med. Engin., Izaak Walton Killam Hosp. Child., Halifax - BIOMED. SCINSTRUMENT. 1974 Vol.10 (125-128)

Small hospitals are particularly vulnerable to problems of patient safety. While they anxiously institute the latest in patient care techniques they may not have the personnel or facilities to utilize these techniques without presenting a hazard to the patient. The authors' safety program has proven successful for small hospitals because it involves the support of the administrator since it is instituted only on his request. It involves the support of the hospital staff since they institute the recommendations, and it emphasizes education of hospital staff. Hospital staff even request education programs since they begin to recognize the need as they are asked to institute some of the recommendations. While the program has not completed a full cycle in all hospitals it is sufficiently advanced so that it has been helpful in ensuring that the patient care instrumentation is safely and effectively used.

3635. Dangerous electricity enunciator and detector - Steadman J.W. - Electr. Engin. Dept., Bioengin. Program, Univ. Wyoming, Laramie, Wyo. - BIOMED. SCINSTRUMENT. 1974 Vol.10 (129-132)

Investigations into electrical accidents in hospitals have shown that the hazards are usually associated with the simultaneous use of 2 or more instruments. Recognizing this, several groups have written safety standards which limit the allowable potential difference between any 2 conductors near or connected to the patient. Implementing such a standard may be difficult since there may be a large number of such conductors and they must be tested using all combinations of 2 conductors. A simple scanning circuit using programmable operational amplifiers (PRAMs) and MOS digital circuitry makes the series of safety checks quickly and efficiently. The design includes both the ability to detect dangerous conditions and a digital enunciator to indicate which of the many leads being checked simultaneously is at fault. The scanning rate is rapid enough to allow the detection of dangerous transients. Preliminary results indicate that this portable, battery operated device is useful in providing an electrically safe environment for patients.

7. SURGICAL INSTRUMENTS

3636. High speed pneumatic drill for biopsy of thyroid lesions - Sachdeva H.S., Wig J.D., Kanta C. and Dutta B.N. - Dept. Surg., Postgrad. Inst.

Med. Educ. Res., Chandigarh - ARCH.SURG. 1974 108/5 (744-745)

Diagnoses were obtained in 54 patients with different thyroid disorders with use of a high speed pneumatic drill biopsy machine. The procedure requires only a small, skin incision and can be safely performed as an outpatient procedure with the patient under local anesthesia. Because of the small size of the tissue obtained, the processing is rapid and a histological report can be obtained within 24 hr. The tissue is not traumatized and the cellular architecture is well maintained in the specimen. The drill biopsy accuracy rate was 92.6%, whereas the clinical accuracy was 80%. No complications were encountered in the study. This study indicates that drill biopsy is an important diagnostic tool that can be safely recommended before performing major thyroid surgery.

3637. Soft tissue stitching instruments - Kapitanov N.N., Petrova N.P. and Yurasova N.V. - All Union Sci. Res. Med. Equipment Test. Inst., Moscow - BIOMED. ENGINEERING (N.Y.) 1973 7/5 (315-316)

The SMT 2 and SMT 3 soft tissue stitching instruments are intended for applying linear sutures on blood vessels, biliary ducts, ureters, pericardium, etc. They were developed to take the place of the 1953 model of single staple apparatus. The design of both models is the same.

3638. A technique for the preparation of plugs of articular cartilage and subchondral bone - Lipshitz H. and Glimcher M.J. - Dept. Orthop. Surg., Harvard Med. Sch., Child Hosp. Med. Cent., Boston, Mass. 02115 - J.BIOMECH. 1974 7/3 (293-294)

A technique for preparing plugs of articular cartilage and underlying subchondral bone wherein the surface of the tissue is both flat and perpendicular to the underlying bone is described. The tools needed to orient and cut the specimens, which were made for this purpose, are also described.

3639. Alternative device for vascular stapling anastomosis - Inokuchi K. and Kusaba A. - II Dept. Surg., Kyushu Univ. Sch. Med., Fukuoka - J.CARDIOVASC.SURG. (Torino) 1974 15/4 (458-460)

A simplified vascular stapling apparatus was devised. Due to the utilization of straight platforms for the stapling of the vascular stumps, the instrument is of a simple structure and, therefore, of cheaper construction and both end to end and end to side anastomoses can be performed with an angling device of the stapling part.

8. NEW INSTRUMENTS

3640. Digital computer Siemens 330. Hardware and principal possibilities of application - SIEMENS PROZESSRECHNER 330. HARDWARE UND EINSATZSCHWERPUNKTE - Offer U. and Scheider U. - Bereich Mess- Prozesstechn., Siemens AG, Erlangen - SIEMENS Z. 1973 47/5 (348-354)

The new digital computer Siemens 330 is compatible with the 320 as regards hardware and

software. Whereas the 220 was developed for tasks in the central memory version, the 330 has been designed especially for operation with peripheral memories.

3641. Digital computer Siemens 330. Software system - SIEMENS PROZESSRECHNER 330. SYSTEM SOFTWARE - Scheider U. and Simang B. - Bereich Mess- Prozesstechn., Siemens AG, Erlangen - SIEMENS Z. 1973 47/5 (355-359)

The capacity of the Siemens 330 digital computer is fully used by the extensive software system, harmoniously adjusted to the hardware. Its use as segment, program and data memory depends essentially on the use of the peripheral memory units (fixed and positionable disk memory units). Thus, it is for example possible to organize also very extensive and data intensive client systems with a limited extension of the central memory in a multiprogram operation.

9. COMPUTER APPLICATIONS

3642. Cybernetic methods of drug design. I. Statement of the problem - the perceptron approach - Hiller S.A., Golender V.E. and Rosenblit A.B. - Inst. Organ. Synth., Acad. Sci., Latvian SSR, Riga - COMPUTERS BIOMED. RES. 1973 6/5 (411-421)

It is revealed that the problem of drug design which is at present coped with on a semi intuitive basis may be interpreted in terms of modern pattern recognition theory as a problem of discriminating two classes of objects: the active and the inactive chemical compounds. In the meantime two questions are essentially important: the presentation of information on the structure of a chemical compound, i.e., the elaboration of terms for adequately describing the structure and the selection of a recognition algorithm. This paper deals with the perceptron approach to the resolution of the problem. The structure is, therefore, presented as a sequence of certain coded functional groups and is projected onto the perceptron retina. The error correction procedure with adaptation of S A connections is employed for classification. The perceptron approach limitations are examined.

3643. Goals and performance in computer programming - Weinberg G.M. and Schulman E.L. - Dept. Hum. Sci. Technol., Sch. Adv. Technol., State Univ. New York, Binghamton, N.Y. - HUM.FACT. (Balt.) 1974 16/1 (70-77)

In all studies of human performance, the experimenter must be certain that the subject is performing the task that the experimenter believes he has set; otherwise results become uninterpretable. Early studies of computer programming have shown such wide variations in individual performance that one might suspect that subjects differed in their interpretation of the task. Experiments are reported which show how programming performance can be strongly influenced by slight differences in performing objectives. Conclusions are drawn from these results regarding both future experimentation and management practices in computer programming.

3644. Auxological model by polynomial regression

- Ghezzi F., Jovine R., Orecchio F. and Stigliano M. - Ist. Ig., Univ. Catt. S. Cuore, Roma - ACTA MED.BROM. 1973 11/2 (148-158)

A sample population is considered. Nine attributes are measured on a random group of 152 males old 6-11 yr old. Starting from these original data an auxological model is carried out, using digital computer technique.

3645. A method for automatic storage and retrieval of alphabetic autopsy diagnoses coded by computer

- Sutinen S., Koskinen P. and Vastamaki R. - Dept. Pathol. Anat., Univ. Turku - LABINVEST. 1974 30/6 (762-766)

An economical method is described for automatic storage and retrieval of autopsy diagnoses without hand coding. The system accepts the input of simplified Latin diagnoses which are coded by the computer according to their content. This requires a standard composition of diagnoses and correct spelling, but allows a certain freedom of expression and involves little extra secretarial work. Internal code numbers save memory space in the computer. Also for economy, the maximum number of diagnoses per autopsy is limited to 35 and that of various diagnoses in the system to 3264. These limits are arbitrary and can be changed if needed. The main files are autopsy, diagnosis, and collecting files. The output includes several administrative reports and statistics as well as the printing of the front sheets of the protocols, reports to the coronary register, yearly alphabetical lists of diagnoses, and a concordance of diagnoses in book form. In addition, cases may be retrieved using any part of the diagnosis as the key word. Examples of retrievals are given.

3646. Sharing: a death research information exchange

- Branscomb A.B. and Branscomb E.W. - OMEGA 1973 4/3 (243-249)

A proposal for the establishment of a computer supported system of direct data sharing between death researchers is briefly outlined. The proposal is intended to stimulate discussion eventually leading to support for the design and construction of such a system.

3647. Selection of a computer for a university

- DIE AUSWAHL EINER EDV ANLAGE IM HOCHSCHULBEREICH - Schoenauer W. and Berger M. - Rechenzent., Univ. Karlsruhe - ELECTRON.RECHENANLAGEN 1974 16/2 (44-49)

There is a danger of subjective decision in selecting a computer. The decision of the selecting committee should be rendered objective and clear by the proposed selection procedure. Composition of the selecting committee, selection and weighing of criteria as well as the evaluation of the computers are all discussed. The selection procedure of a central digital computer for a university is presented as an example.

9.1. Hospital automation

3648. Frame selection systems and languages for medical applications - LeBeux P.J. - THESIS, UNIV.CALIF. 1974 (4p.)

A frame selection system and a frame programming language were implemented to support medical information system applications. A frame selection system is an interactive computer system which enables the user to enter data via a CRT terminal, by using a selection device to point at items or phrases displayed on the screen. A frame is a set of choices representing the alternatives available to the user at each stage of a selection process. A model was developed to study the capabilities of frame selection systems.

9.1.1. Laboratory techniques

3649. The computer system of the Swiss Red Cross Regional Blood Transfusion Center in Lausanne

- DAS COMPUTER SYSTEM DES REGIONALEN BLUTSPENDEZENTRUMS SRK VON LAUSANNE - Wuilleret B. - Reg. Blutspendezent. SRK, Lausanne - ARZTL.LAB. 1974 20/3 (87-94)

The electronic data processing (EDP) system of the Swiss Red Cross Regional Blood Transfusion Center in Lausanne is described. Two different EDP systems were used. The first one was operated from 1968 until the summer of 1970, the second has been in operation since that time. The main reason for the introduction of an EDP system was the discrepancy between the calculated optimum number of staff members and the actual inadequate number in 1967. The main EDP requirements of the various departments of the institute as well as the respective advantages and disadvantages of 2 EDP systems are described and discussed. Some data on the costs and the analysis and programming conditions of such a system are given, and an attempt is made at defining the criteria which were decisive for the introduction of electronic data processing at the Center.

3650. The computer system of the Blood Donor Service of the German Red Cross in Rhineland Palatinate

- DAS COMPUTER SYSTEM DES DRK BLUTSPENDEDIENSTES RHEINLAND PFALZ - Bitz H. - DRK Blutspendedienst Rheinland Pfalz, Bad Kreuznach - ARZTL.LAB. 1974 20/3 (94-100)

The Rhineland Palatinate blood donor service of the German Red Cross uses a RUF magnetic ledger card computer for the compilation of the following data: blood donors, organization of donation dates, conserved blood and statistics. The configuration of the system and its practical application are briefly described.

3651. The use of computers in the Blood Donation and Transfusion Service

- VORBETRACHTUNGEN ZUM RECHNEREINSATZ IM BLUTSPENDE- UND TRANSFUSIONSDIENST - Lensch S., Roos D. and Busch H. - Abt. Med. Dokumentat. Statist., Bluttransf. Dienst, Univ. Klin., Univ. Krankenh., Hamburg/Eppendorf - ARZTL.LAB. 1974 20/3 (101-108)

Following a definition of the typical work units in the transfusion service of the Federal Republic of Germany, the possibilities and aims of data processing in this field are outlined with reference to a development project.

3652. An off line clinical chemistry computer system - Vitek P., Chiu S., Healy M.J.R. and Lucas D. - Div. Comput., MRC Clin. Res. Cent., Harrow - ANN.CLIN.BIOCHEM. 1974 11/3 (86-90)

A low cost computer based data processing system for a middle size clinical chemistry laboratory is described. The emphasis is laid on organizing the laboratory work, minimizing the amount of clerical and arithmetic work undertaken by the technicians, and providing positive specimen identification. Details of specimens arriving for analysis are input to the computer, which allocates laboratory numbers and constructs worksheets for the various chemical tests. The results are also input (off line) to the machine, which brings together results of different tests on one specimen and prints out properly identified reports. The accumulated results are transferred to a large remote computer and stored there on an archives file.

3653. A low cost sequencing and timing computer for the laboratory - Toms D.J. - Dept. Phys. Astrophys., Univ. Colorado, Boulder, Colo. 80302 - REV.SCLINSTRUM. 1974 45/4 (534-537)

A general purpose sequencing and timing computer with a program capacity of 100 instructions is described. Program storage is by means of a low cost shift register memory. Input, output, and branching instructions are provided, along with a novel instruction for the creation of DO loops. Complex pulse patterns with pulse durations ranging from 1 μ sec to arbitrarily long times can be easily programmed. Up to eight external devices can be controlled without additional demultiplexing.

3654. Imprecision of laboratory determinations and diagnostic accuracy: theoretical considerations - Lindberg D.A.B. and Watson F.R. - Dept. Informat. Sci. Group, Univ. Missouri Med. Sch., Columbia, Mo. - METH.INFORM.MED. 1974 13/3 (151-158)

Recent studies suggest the determinations of clinical laboratories must be made more precise than at present. This paper presents a means of examining benefits of improvement in precision. To do this a mathematical model is used of the effect upon the diagnostic process of imprecision in measurements and the influence upon these two of Importance of Diagnosis and Prevalence of Disease. The interaction of these effects is grossly nonlinear. There is therefore no proper intuitive answer to questions involving these matters. The effects can always, however, be calculated. Including a great many assumptions the modeling suggests that improvements in precision of any determination ought probably to be made in hospital rather than screening laboratories, unless Importance of Diagnosis is extremely high.

9.3. Clinical diagnosis

3655. Computer diagnosis in the class of compatible diseases with reference to tumors and tumorlike formations of the female internal genitalia - Bykhovskii M.L., Selezneva N.D. and Kuzin V.F. - All Union Sci. Res. Inst. Obstet. Gynecol., Min. Hlth USSR, Moscow - BIOMED.ENGINEERING (N.Y.) 1973 7/4 (205-208)

It is general diagnostic practice to classify certain combinations of diseases as a single nosological form. Thus, the frequent presence of combinations has led to an appreciable expansion of the list of nosological forms. A diagnostic system combining the main nosological forms without isolating them into independent forms is rational; it is preferable to consider a class of compatible diseases. On the basis of this principle, all diseases under study and amenable to computer diagnosis (58 nosological forms) were divided into four classes: tumors and tumorlike formations of the uterus (23), nonblastomatous tumorlike formations of the uterine appendages (13); benign tumors of the uterine appendages (12); and malignant tumors of the uterine appendages (10). To check the effectiveness of the operation of this diagnostic system a retrospective diagnosis (based on the data of case histories from the archives of the Institute of Obstetrics and Gynecology) was made for 1390 patients with verified diagnoses (established during surgery and by histologic investigation of preparations). Having determined the effectiveness of the system on archive case histories, computer diagnosis was applied in the clinic simultaneously with clinical examinations of patients before surgery. Diagnosis was established by computer in 367 patients during preoperative examination, who then underwent surgery. This diagnostic system proved highly effective and showed good prospects for its clinical use. The cybernetic system of computer diagnosis in a class of compatible diseases can be used as a machine consultant (so called distant diagnosis) and for peripheral clinics with which the computer should be connected by teletype channels. (Vlachos - Athens)

3656. Mathematical and statistical methods for the examination of spinal posture by means of a computer - MATHEMATISCH STATISTISCHE METHODEN ZUR UNTERSUCHUNG DER WIRBELSAULENHALTUNG MITTELS COMPUTER - Beck A. and Killus J. - Flugmed. Inst., Luftwaffe, Furstenfeldbruck - BIOMED.TECHN. 1974 19/2 (72-74)

An ideal type of spinal column can be exactly determined with 68 data. It was necessary to develop new methods of measurement and definitions for all 68 data determined. Linear correlations between the 68 data could be obtained with the aid of the coefficient of correlation. Ideal spinal columns and ideal sacra may be shown through polynomes. The practical implication of the method for functional assessment is outlined.

3657. Computer generated, synthetic cell images - Bartels P.H., Bhattacharya P.K., Bellamy J.C. et al. - Dept. Microbiol., Univ. Arizona, Tucson, Ariz. - ACTA CYTOL. (Balt.) 1974 18/2 (155-164)

The desire to automate certain aspects of cytologic prescreening may be responsible for some of the attempts at quantitation, but most of the problems demanding objective quantitative answers exist in their own right. Recent results of objective cell image analysis suggest that there may in fact not even be an 'objective' basis for the assumption of discretely different, distinct cell types. Subjectively these are well established entities, but they may well be the result of complex psychophysical human recognition mechanisms, rather than a matter of fact. To understand any process it is helpful to bring it under experimental control, and to make it reproducible. As far as decision making on cytologic material is concerned, this means that one would have to be able to simulate, from a given stochastic model, the images of cells with known properties, and to have such images assessed by qualified cytologists. With the generation of cell images under computer control, each determining parameter defining the cell image properties can be varied. It should then be possible to explore in an iterative fashion the processes entering into diagnostic decision making. This paper presents the approach taken, and some initial results obtained with a program generating synthetic cell images by computer.

3658. Approach to a reliable program for computer aided medical diagnosis - Birk R.E., Endres L., McDonald J.C. et al. - Saint John Hosp., Detroit, Mich. 48236 - AEROSPACE MED. 1974 45/6 (659-663)

Application of computers to diagnosis of congenital heart lesions, epigastric pain, and others began to appear in the mid 50s. For a number of reasons, their application has been limited but all have raised interesting possibilities for the future and have served as provocative studies of the diagnostic process. Some have used a pattern recognition technique for diagnosis, others have used an analysis of variance approach, and all of them have brought to light deficiencies in the current statistical base generated by the study of diseases, all finding that we do not always know with accuracy the incidence of a given symptom or sign in a particular disease nor, indeed, its significance for diagnosis, which may be more important than its frequency. The data for this study were collected over a period of 4 yr from the charts of several Detroit area hospitals: Henry Ford Hospital, Saint John Hospital, and Providence Hospital. The weight summation analysis appears to be a reliable computer aided medical diagnostic method, comparing very favorably with the Bayes theorem program. It must be emphasized that, for either method, the data base is an important governing factor as to the program's reliability. The practical application of these methods in assisting physicians in diagnostic procedures appears to have a potential in increasing the accuracy of medical diagnosis and the saving of a physician's time to be used for the more clinical demands upon him.

3659. Development and validity of a computerized method for diagnoses of functional psychoses (DIAX). Evaluation based on comparison with

clinical diagnosis, prognosis, 'stability', and family history - Fischer M. - Inst. Psychiat., Aarhus State Hosp., Univ. Aarhus, Risskov - ACTA PSYCHIAT.SCAND. 1974 50/2 (243-288)

Comparison of the results of studies within psychiatry are often complicated by the uncertainty of whether the different authors use the same diagnostic criteria for the probands in the studies. In the International Pilot Study of Schizophrenia (IPSS) (WHO), patients with functional psychoses from the nine participating centres were examined with standardized instruments. This study is based on data collected during the initial examination and a 2 year follow up of patients included in the IPSS. The aim was to develop and test a method based on symptoms which diagnosed the patients in a standardized way. A computer programme using 39 symptom groups was developed, (DIAX). (A manual is included in the Appendix). In order to evaluate the diagnoses arrived at by DIAX, comparison was made with clinical diagnoses at initial examination and at follow up. For the total of 1202 patients from nine countries, the overall agreement was 73%. The comparison also showed interesting similarities and differences among the centres. The validity of the method was supported by the following three analyses. The stability (diagnoses based on initial examination and follow up examination) was high. Severe disagreement was only about 10%. The prognosis of the two major diagnostic groups showed a significant difference. An examination of mental illness in the families showed that DIAX diagnoses could separate two groups, those with mainly schizophrenia in the family and those with mainly affective psychoses in the family. Other results emerging from the study and the advantages and limitations of the method are discussed.

3660. A computer aided diagnostic system using a small desk top computer calculator - Horrocks J.C. - Univ. Dept. Surg., Gen. Infirm., Leeds - METH.INFORM.MED. 1974 13/2 (83-88)

This report describes in detail a simple cheap computer aided diagnosis system based around a WANG 700 C desk top computer/calculator and a WANG 711 input/output writer. Total costs of the system are less than £1,000 per annum. A single diagnosis takes around 3-5 min to perform, and the use of the system can be learnt within 30 min. Accuracy is of the order of 90% for acute abdominal pain and some degree of flexibility and geographical compatibility has been achieved. Additional problems in implementation are discussed.

3661. Subjective probability and diagnosis - SUBJEKTIVE WAHRSCHEINLICHKEIT UND DIAGNOSE - Sadegh Zadeh K. - Inst. Theorie Geschichte Med., Munster/W. - METH.INFORM.MED. 1974 13/2 (97-102)

Because of the probabilistic character of the symptom disease and disease symptom correlation, only probabilistic diagnosis is possible. The optimization of the diagnostic therapeutic decision seems to be the most reasonable diagnostic strategy. For an adequate realisation of this strategy, the concept of probability within the probabilistic diagnosis has to be elucidated.

This paper deals with this problem, which leads directly to the inductive logic of the diagnosis.

3662. Mathematical model for medical diagnosis - Wartak J. - Dept. Med., Univ. Alberta, Edmonton - COMPUT.BIOL.MED. 1974 4/1 (79-84)

Medical diagnosis is viewed as a problem in statistical classification wherein an N dimensional sample space is partitioned into categories (diseases). Members (patients) of the categories (diseases) are each represented by an ordered sequence of n numbers, or equivalently as a data vector in an N dimensional hyperspace. Assuming there exists a probability distribution associated with each category, the patients data vector is to partition the space in an optimal fashion, i.e. it is assigned to the category (disease) in whose region it falls with the greatest probability. Before making the final decision certain optimization rules may be used.

3663. A non probabilistic method for automatic medical diagnosis - Cumberbatch, Leung K.V. and Heaps H.S. - Dept. Computing Sci., Univ. Alberta, Edmonton - INT.J.BIOMED.COMPUT. 1974 5/2 (133-146)

A non probabilistic method of automatic diagnosis is formulated and applied to a data base of 300 gastro enterological patients known to have one of six diseases determined by radiological diagnoses. Application of the method requires no assumptions regarding the statistical independence of symptoms. Any order of mutual dependence of symptoms may be allowed for by appropriate choice of terms in the disease symptom function. For the particular data base the accuracy of the automatic diagnosis exhibits an improvement of almost 10% above that obtained with an alternative method described by the authors in a previous paper. The proposed method is also used to predict new patients diseases which are not contained in the original data base. The resulting accuracy of prediction is discussed with reference to the influence of size of data base, and the effect of inclusion of linear and quadratic terms in the disease symptom functions. It is emphasized that choice of the mathematical model for automatic diagnosis should be dependent on the size, as well as the statistics, of the data base.

3664. Theory development in medical decision making - Stein M.A. and Winter J. - Dept. Radiol. Sci., UCLA Sch. Med., Los Angeles, Calif. - INT.J.BIOMED.COMPUT. 1974 5/2 (147-159)

After exploring current concepts of disease and diagnosis, it is apparent that medical diagnosis has a number of serious shortcomings. An overview of a method for developing a formal logical diagnostic model is presented, as well as suggestions for practical applications of this model.

9.4. Electrodiagnosis

3665. Analysing a patients health using computers - Schroer B.J. - Sch. Prim. Med. Care, Univ. Alabama, Huntsville, Ala. 35807 -

INT.J.BIOMED.COMPUT. 1974 5/2 (119-132)

This research consists of the development of a computerized technique for assisting the physician in analyzing a patients health. Using the patients physical examination, the technique summarizes the patients prior medical data, determines if the patient is normal or abnormal, identifies those clinical variables which are significantly affecting the patients health, and observes any drift in the patients health.

9.4.1. Electrocardiography

3666. Detection of ventricular arrhythmias in real time with a portable analog computer - Cannom D.S. and Harrison D.C. - Cardiol. Div., Stanford Univ. Sch. Med., Stanford, Calif. 94305 - AMER.J.CARDIOL. 1974 33/3 (399-402)

Recent studies on the occurrence of sudden death emphasize that many patients have ventricular premature contractions as prodromes of lethal arrhythmias. A portable, 6 ounce analog computer was developed to detect tachycardias (heart rate 150 to 190 beats/min), bradycardias (heart rate less than 50 beats/min) and ventricular premature contractions. When preset limits are exceeded, acoustic warnings are sounded, and the patient may transmit his electrocardiogram by telephone, without additional equipment, to a receiving device that graphically reproduces the electrocardiogram in real time. Hospital studies in 26 ambulatory patients with a variety of arrhythmias were completed. Tachycardias and bradycardias were detected in every instance during 30 observation periods in 6 patients. Reproducible warnings were triggered in 19 of the 20 patients with ventricular premature contractions of various configurations during each of 5 observation periods (100 observations). In one patient, the electrical vector of the ventricular premature contraction closely resembled the normal QRS vector and was not detected. Appropriate electrode placement is essential to avoid initial Q waves and to maximize the difference between the vector of ventricular premature contraction and that of the normal QRS complex. No false positive acoustic alarms were sounded. The authors demonstrated that it is possible to detect ventricular premature contractions readily and reproducibly in ambulatory patients. Use of this detector may permit large scale monitoring of patients with a high risk of sudden death.

3667. Computer analysis of electrocardiograms using various programs - COMPUTERANALYSE DES ELEKTROKARDIOGRAMMS MIT VERSCHIEDENEN PROGRAMMEN. I. FORMANALYSE - Meyer J., Heinrich K.W., Merx W. and Effert S. - Abt. Inn. Med. I, Rhein. Westfal. Techn. Hochsch., Aachen - DTSCH.MED.WSCHR. 1974 99/23 (1213-1223)

The diagnostic reliability of the computer programs Gordy/Mount Sinai Hospital, Caceres, Smith/Mayo Clinic, and Arvedson as well as 2 programs with a common measuring component from Riedl and modified diagnostic criteria of the USPHS as well as the Minnesota convention was investigated for 252 electrocardiograms. The

results of the form analysis were analyzed in detail and compared with independent reports from 3 doctors. It was shown that differences in the results from the doctors and the computer programs were due both to the problems of ECG measurements and also to lack of specificity of diagnostic criteria. Faulty diagnosis of P wave changes occurred chiefly due to artifacts and difficulties in measurement. Pathological ST-T sections were in general reliably recognized by the Pordy, Riedl and Arvedson programs as well as the 3 doctors. The Smith program gave valid reports of T wave anomalies but was weak in the diagnosis of the ST segment on technical grounds. While the various infarct patterns were reliably diagnosed and classified by the Pordy and Caceres programs the remaining programs resulted in numerous errors. The Arvedson program misdiagnosed 7 out of 8 cases of an anterior infarct. Signs of hypertrophy as well as complete bundle branch block were mainly correctly recognized whereas incomplete blocks were often missed. As a whole there were definite differences between the individual computer programs. The doctors reports were clearly superior to the mechanical ones even if not always faultless.

3668. Progress in electrocardiology. Part 1: polarcardiography and data acquisition - Dower G.E. - Polarcardiograph Dept., Shaughnessy Hosp., Vancouver - BIO-MED. ENGINEERING (Lond.) 1974 9/6 (240-244)

When considering electrocardiography and vectorcardiography to be branches of electrocardiology, a third branch may be added: polarcardiography. Polarcardiography is a display of the heart vector in polar coordinates, which presents relevant information more explicitly. Several systems for the analogue transformation of coordinates were developed and a completely practical system is now available. Its development has also extended to the design of the interface with the patient and various aspects of the acquisition and recording of cardiac electrical data.

3669. Computerised analysis, interpretation, storage and retrieval of electrocardiograms. A study and review of available systems - Brink A.J., De W. Vivier C. and Van Wyk J.D.N. - Cardiol. Unit, Tygerberg Hosp., Tiervlei - S.AFR. MED. J. 1974 48/27 (1141-1146)

A study was undertaken to determine the feasibility of introducing a computerised electrocardiographic analysis and interpretive system as a service to a teaching and referral hospital. Available computer equipment and programmes are considered. The accuracy and quality of the analysis and interpretation of the electrocardiographic contours are basically dependent on such factors as pattern recognition, the criteria adopted for determining abnormalities, the relative values placed on scalar and orthogonal leads and the role of review by the physician. It is concluded that such systems are at a stage where they can feasibly be introduced and should be of advantage in freeing the physician from routine measuring and screening of electrocardiograms, thus saving many

hours of professional and academic time. Furthermore, such systems can contribute greatly as an educational tool and increase the general knowledge of electrocardiography. Systems for storage and retrieval are also being developed and becoming available. The whole field is a developing one and continuous updating of programmes by the addition of more data, particularly for children, and the introduction of electrocardiographic comparison programmes need to be expedited.

9.4.2. Electroencephalography

3670. Certain validity problems in computer analysis of clinical EEGS - Fox B.H. - Perinat. Res. Branch, Nat. Inst. Neurol. Dis. Stroke, NIH, Bethesda, Md. 20014 - ANN. N.Y. ACAD. SCI. 1973 Vol. 215 (321-324)

Using computer analysis for strictly clinical purposes is not a widespread practice. Certain technical problems have delayed such use at a developmental level and, even when good techniques are developed, other problems tend to hinder it at a practical level. This discussion deals with 2 validity problems in drawing inferences from computer analysis. Because clinical application is so limited, it was deemed better to address these problems by example as they are encountered in a research question with few criterion outcomes, but with aspects of a quasicalinical situation, and then to extrapolate to clinical determinations. That research question is sleep stage identification. The first validity problem is the variation of instrumental and analytic approaches to the predictor measure, these measures being the several patterns of wave characteristics (amplitudes, frequencies, forms, etc.) defining the sleep stages. A corollary to this, of course, is the reliability of these measures themselves in any single approach. The second validity problem is the fallibility of criteria. Not only does variation or uncertainty in the definition of criterion measures contribute to this fallibility, but also variation in the measure of the 'true' state of the criterion once it has been defined by a given investigator. In a sense this question concerns the more fundamental issue of defining an acceptable ultimate criterion and its operational description, to say nothing of the ultimacy problem itself if an intermediate criterion is chosen. It is not even certain that the 'true' state is defined rigorously enough to apply to descriptive measure unequivocally, except in the computer instructions.

3671. E.E.G. preprocessing by an on line amplitude and frequency analyser - Dascalov I.K. and Chavdarov D.B. - Inst. Electromed. Instrumentat., Min. Hlth, Sofia - MED. BIO. ENGINEERING 1974 12/3 (335-339)

An EEG preprocessing device is described, based on the signals wave durations and amplitude measurement and their classification into 4 frequency and 3 amplitude bands. The results are ordinarily rewritten on the EEG machine for visual interpretation, in an appropriate polarity and amplitude coded form,

occupying 2 channels for each processed channel. Outputs are provided for oscilloscope monitoring, and further computer processing, etc.

3672. Computer analysis of bioelectrical activity - Werner J. and Jahns R. - Inst. Physiol., Ruhr Univ. Bochum, Bochum Querenburg - INT.J.BIOMED.COMPUT. 1974 5/2 (87-105)

The authors give a survey of the mathematical methods they used for a computer analysis of bioelectrical activity. The methods are introduced systematically first for slow potentials, then for spike trains. The purposes and the mechanism of operation are concisely described. An illustrative example, taken from recent research, is given for each method.

9.6. Drug treatment

3673. Automatic maintenance of the muscular relaxation during general anesthesia (Russian) - Bondarchuk V.I. - Otd. Eksp. Khir., VNII Klin. Eksp. Khir., Moscow - KHIRURGIYA (Mosk.) 1973 49/7 (21-24)

The device AIR-2 was used for the automatic maintenance of relaxation during combined use of relaxants having different types of action. The electromyopotential of the muscles of the hypothenar eminence obtained in response to a single electric stimulus of the ulnar nerve was monitored. Relaxation was induced by injection of an antidepolarizing relaxant (tubocurarine) and was maintained automatically by injections of a depolarizing relaxant (suxamethonium). In 19 clinical investigations carried out under conditions of modern combined anesthesia, the adequacy of 229 automatic injections of suxamethonium was studied. The method significantly facilitates the conduct of anesthesia and holds promise for clinical use.

9.7. Radiotherapy

3674. Digital data processing of images - Lotter M.G., Minnaar P.C., Verster F. et al. - Nat. Hosp., Bloemfontein - S.AFR.MED.J. 1974 48/23 (986-991)

Digital data processing was investigated to perform image processing. Image smoothing and restoration were explored and promising results obtained. The use of the computer, not only as a data management device, but as an important tool to render quantitative information, was illustrated by lung function determination. The availability of on line computers for image processing represents a major advance in the radiological investigation of organ function.

9.8. Medical record documentation

3675. Casualty activity analysis coding and computing - Dalby B.C.S., Farrer J.A. and Harvey P.W. - Computer Lab., Lancaster Univ., Lancaster - COMPUT.PROGR.BIOMED. (Amst.) 1974 3/5 (254-266)

This paper describes the technique employed

to establish the details of the workload of a Casualty Department, one of the less complicated components of a hospital. This has been achieved by retrospective coding of all the information on a 1:7 sample of the clinical cards from 1 yr and the analysis of this data by conventional data processing methods.

3676. The application of computer simulation modeling to the radiology film library - Evens R.G., Falvey N.J., Jost R.G. and Hill R.L. - Mallinckrodt Inst. Radiol., Washington Univ. Sch. Med., St. Louis, Mo. 63110 - RADIOLOGY 1974 112/2 (319-325)

A radiology film storage and retrieval system (film library) was studied by means of a computer simulation model. The current operation of the film library was studied and a model of the library was used to demonstrate which functions might be most susceptible to overloading and insufficiency. This is a valid technique for systematic study of a radiologic film library and is also useful for many other complex administrative problems.

9.10. Function tests and techniques

3677. Computer assisted analysis of insulin response to glucose stimulus - McReynolds C.R., Shah S. and Stoffer R.P. - Hertzler Res. Found., Hertzler Clin., Halstead, Kans. 67056 - ANN.CLIN.LAB.SCI. 1973 3/6 (454-464)

Concomitant measurements of plasma insulin levels were performed on all samples of blood obtained from 1,408 patients undergoing a diagnostic oral glucose tolerance test. These patients had no prior diagnosis of diabetes but qualified for the study because of either suspicious history, family history, or signs and symptoms. Graphic display of the findings, with insulin plotted as percent increase over basal level and glucose as milligrams per 100 ml, resulted in recognizably distinct patterns of response in both nondiabetic and diabetic patients. Computer assisted analysis of these, along with correlation of the factor of obesity, confirmed the recognizably separate patterns. The concept of the initial lesion of insulin deficiency of diabetes as one of rate rather than magnitude tends to be confirmed. It was concluded that the routine and simultaneous performance of plasma insulin levels during oral glucose tolerance tests was of value in the diagnosis of various stages of diabetes and in selection of the proper treatment regime.

3678. A genetic register system (RAPID) - Emery A.E.H., Elliott D., Moores M. and Smith C. - Univ. Dept. Hum. Genet., West. Gen. Hosp., Edinburgh - J.MED.GENET. 1974 11/2 (145-151)

Justification is given for establishing a genetic register system as a means of ascertaining and preventing genetic disease. Such a computerized register system, referred to by the acronym RAPID (Register for Ascertainment and Prevention of Inherited Disease), has been established in Edinburgh. The system involves ascertaining individuals in the population at risk

of having a child with a serious genetic disorder through various record systems and statutory registers. Procedures for contacting and following up individuals found to be at risk are discussed. Computer methods for the recording, storage, and retrieval of individual and family data are described. Because of population mobility and the geographical dispersal of family members a Genetic Register System is more likely to be effective if organized on a national basis.

9.10.1. Blood circulation

3679. Continuous estimation and plotting of measures of cardiac ventricular function using parallel hybrid computer techniques - Taylor D.E.M., Strong A.J. and Whamond J.S. - Univ. Edinburgh - INT.J.BIOMED.COMPUT. 1974 5/1 (23-37)

The shape and asynchrony of contraction of the cardiac ventricle make the determination of myocardial contractility difficult. A number of possible measures have been suggested and it has been found that a selection of estimates gives the best overall picture of the efficiency of the myocardium. The estimates used are all derived data from left ventricular pressure, aortic flow and velocity, either singularly or in combination. A parallel hybrid computer program has been developed to permit the continuous estimation of the required variables. The output data is available either on a beat by beat basis, or by using an analog implementation of time weighted statistical variables as an automatically updating mean and variance.

3680. Computerized system for noninvasive techniques. I. Its value for systolic time intervals - Zonerach S., Zonerach O. and Rodenrys J. - Div. Cardiol., Queens Hosp. Cent., Jamaica, Queens, N.Y. 11432 - AMER.J.CARDIOL. 1974 33/5 (643-649)

A total computerized system for the study of the noninvasive techniques and especially for external systolic time intervals is presented. Heart rate, left ventricular ejection time index (LVETI), Q-S₁I (electromechanical index), preejection period (PEP), PEP/LVET ratio, isovolumic contraction time corrected for pulse transmission (ICTc), electromechanical interval (EMI), mechanical systole (S₁-S₂), DA/DT (quantitative apex cardiogram) and heart sounds were calculated from simultaneous recordings of electrocardiogram, carotid pulse and apex cardiogram by a multichannel, multifilter Cambridge MCIV phonocardiograph and by a CVA/94 unit MDS computer program. A parallel study of these variables in 100 healthy persons by conventional manual calculations made from the Cambridge recordings and by the CVA/94 MDS computer system revealed identical results. The computerized system could more rapidly and accurately calculate many variables for systolic time intervals, thus offering the possibility for better evaluation of left ventricular function. Regression equations in relation to heart rate were found only for Q-S₂ = 520.4 - 1.79 heart rate; LVET = 417.5 - 1.59 heart rate; and S₁-S₂ = 435.7 - 1.58 heart rate. ICTc and EMI

differences were negatively correlated at the P = 0.001 level. LVETI and Q-S₂ correlated positively at the P = 0.01 level. DA/DT reflecting quantitative apex cardiography could be calculated only by computer.

9.10.2. Respiratory system

3681. A thermistor anemometer for ventilation measurement with low flow resistance - EIN THERMISTORANEMOMETER ZUR WIDERSTANDSARMEN VENTILATIONSMESSUNG - Appel E. - Neurochir. Univ. Klin., Dusseldorf - BIOMED. TECHN. 1974 19/3 (112-117)

In the computer aided intensive care prolonged measurement of the ventilation should be aimed at. Because of its flow resistance the pneumotachograph (Fleisch) can be used in spontaneously breathing patients only for short term measurements. A flow measuring device has been developed that uses a transducer with lower flow resistance (0.29 mm H₂O at 60 l/min), reducing additional breathing work. The measuring principle is a temperature corrected thermistor anemometer working with constant temperature. By use of two thermistors direction sensitive flow measurement could be realized. Linearization of the non linear characteristic of the measuring device is done with a 10 diode function generator for flow volumes up to 120 l/min. The usefulness of the device for ventilation measurement is demonstrated by two examples.

9.10.3. Nervous system

3682. Computer analysis of EEG wakefulness sleep patterns during learning of novel and familiar sentences - Lehmann D. and Koukkou M. - Neurol. Klin., Univ. Zurich - ELECTROENCEPH.CLIN.NEUROPHYSIOL. 1974 37/1 (73-84)

In learning experiments novel and familiar sentences were presented acoustically to human subjects during EEG slow wave sleep. Frequency spectra of parieto occipital and temporo occipital EEGs were analyzed 25 sec before and 5-30, 30-55 and 55-80 sec after presentation. Statistical comparisons between spectra were performed, using the distribution means. Three qualities of learning were distinguished in tests after the termination of sleep: 'spontaneous recall', 'recognition' and 'no recall, no recognition'. The presentations caused EEG activations of different levels and durations. The cases of 'no recall, no recognition' were associated with the lowest EEG activations. Significantly higher and longer activations were found when learning was successful, indicating a systematic relationship between level of EEG activation after presentation of the material, and quality of learning. Further, for the same quality of learning, significantly higher activations were associated with novel than with familiar learning material. Thus, the EEG pattern which exists after the input of learning material to the brain reflects the brain functional state whose level (as characterized by EEG wave frequency) and duration (in conjunction with the factors:

interference and difficulty of the learning task) determines the possibility of later recall.

3683. A computer method for the analysis of ocular refractive data - Woodruff M.E., Adamack T. and Samek M. - Sch. Optom., Univ. Waterloo, Ont. - CANAD.J.PUBL.HLTH 1974 65/3 (224-229)

Numerous analytical investigations of data from vision examinations have been reported in the past century, most of which were limited to small samples because calculations often had to be performed by calculators or by hand. A method of coding and assembling ocular refractive data derived from vision examinations is described. This method can be used on large samples, allowing a wide variety of mathematical calculations, and data assembly correlations to be accomplished by a computer in a fraction of the time required for similar hand calculations.

3684. Computer automated measurement of eye movement parameters with applications to electro oculography and nystagmus movements - Troelstra A. and Garcia C.A. - Dept. Electric. Engin., Rice Univ., Houston, Tex. 77001 - COMPUT.PROGR.BIOMED. (Amst.) 1974 3/5 (231-236)

A computer program was developed to evaluate certain signal parameters in eye movement patterns. The program will detect zero crossings in a predetermined direction (event), disregard erroneous zero crossings caused, for example, by short duration blinks, and provide a number of pre and post event samples of the signal. The samples can be used to determine electrooculogram amplitudes and changes in these amplitudes over prolonged periods of time in cases of clinical interest, or the slope of the slow phase and amplitude of the fast phase in nystagmus eye movement. The use of the program is not restricted to eye movement signals, but it can be used whenever a signal parameter (amplitude, slope, time between zero crossings, etc.) has a specific time relationship to the zero crossings of that signal.

3685. Programs for a statistical analysis of evoked potentials - Horvath R.S. - Electric. Engin. Dept., Michigan Technol. Univ., Houghton, Mich. - COMPUT.PROGR.BIOMED. (Amst.) 1974 3/5 (249-253)

Three LINC programs are described which can be used to calculate and display several statistical indicators of a sampled cortical evoked potential waveform. These indicators are: the sample averages, the sample variances, means and variances of the peak value of the initial phase (between 10 and 20 msec following the stimulus) and its latency, and a running plot of both the average and the variance of the peak values of a moving set of 16 consecutive evoked potentials from a total run of a maximum of about 900.

3686. Computer synchronization with neuron action potentials to study related field potentials - Turbes C.C., Schneider G.T., Simard J.M. and Morgan R.J. - Dept. Anat., Creighton Univ. Sch. Med., Omaha, Nebr. 68178 - BIOMED.SCLINSTRUMENT. 1974 Vol.10 (165-172)

This paper describes the processing of analog extracellular neuron activity recorded with

an FM tape recorder using averaging methods. Dual read heads on an FM tape recorder, a pulse height discriminator, and an averaging transients computer were used for the determination of the chronological relationship between extracellular neuronal action potentials and slow wave activity preceding and following the action potential used to trigger the computer. The slow wave and unit activity was studied for evoked potential patterns in the dorsal hippocampus, dorsomedial thalamic nucleus, lateral geniculate, and medial geniculate nuclei. Similar studies were made to determine the chronological relations between action potentials and slow wave activity in areas synaptically related to the regions of the brain mentioned above.

3687. Computerized system for stimulus generation, control, behavioral data acquisition and summary for primate visual psychophysics - Yates J.T. and Harding T.H. - Dept. Psychol. Sci., Purdue Univ., West Lafayette, Ind. 47907 - COMPUTERS BIOMED.RES. 1974 7/3 (200-212)

A computerized system for the collection of visual contrast sensitivity information from nonhuman primates is described. A systems analytical approach is presented in which modulation transfer functions are obtained that describe the spatial resolving power of the visual system. Sample data from humans including a transfer function are presented. Detailed descriptions of all facets of the experimental method are presented. Included are computer software summaries, an instrumentation description, stimulus calibration and display procedures, a description of the psychophysical task, and a data summary. The general method has application to numerous animal psychophysical tasks in which titration schedules are used.

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549 Berne T.V.	1229 Blacker J.H.	97 Borisovskaya G.D.

2442 Borom M.P.	3379 Brennecke R.	3133 Brubacher P.
659 Borsellino A.	49 Brenner S.L.	811 Brubaker T.A.
2776 Borsky P.N.	678 Brennwald J.	1502 Bruchner H.
2418 Bosch K.	2570 Brenot J.	529 Bruck S.D.
1550 Bosco Masera M.	274 Brent B.	643 Bruck S.D.
939 Bosi C.	211 Breslav I.S.	889 Bruck S.D.
1266 Bostick W.D.	493 Bresler P.I.	2421 Bruland H.
2877 Botsford J.H.	276 Brestak M.	1173 Brumberg Y.M.
1001 Bottomley R.C.	1344 Bretschneider G.	1178 Brumm D.B.
2156 Botts J.	1956 Breyer B.	1933 Brune E.O.
1077 Botwin M.R.	1229 Brief R.S.	1726 Bruner J.M.R.
307 Bouckaert A.	1486 Brierley H.G.	1585 Brunner H.
311 Bouckaert A.	574 Bright D.S.	2895 Brunner H.
1848 Bouman L.N.	1414 Bright P.B.	660 Brunsting A.
1826 Bouman M.A.	2693 Briley W.R.	1671 Bruscaioni R.
3351 Bourdarias J.P.	3669 Brink A.J.	1694 Bryan M.E.
2656 Bourgain R.H.	963 Brinker R.A.	3464 Brydon J.W.E.
1546 Bourgoin D.	3600 Brinkmann K.	1275 Brzozowski J.
1652 Bourland H.M.	443 Brissot J.J.	2099 Buchanan B.G.
1638 Bourland J.D.	3152 Broadbent J.	2358 Buchanan R.A.
3566 Bourland J.D.	909 Brocas J.	2804 Bucher K.
1950 Bourne M.	2176 Brocas J.	2804 Bucher K.E.
2736 Bourquin M.H.	3351 Brocas J.	1595 Bucher W.
1395 Bowden E.	2819 Brock M.	1921 Buchheim W.
2333 Bowden M.J.	1065 Brocklehurst J.R.	2424 Buchta I.
1838 Bowen J.M.	3216 Brockman W.H.	1203 Buckingham M.J.
2560 Bowers F.K.	173 Brodwin M.E.	2269 Buckle P.M.
2077 Bowley A.R.	3005 Brody D.A.	1375 Buckley J.D.
1971 Bowman G.A.	3006 Brody G.	1752 Buckley J.D.
1326 Bowman M.J.	3359 Brody W.R.	3286 Buckmaster H.A.
1864 Bowron P.	1889 Bromley K.	404 Budak A.
1711 Boyd D.	1541 Bronner L.R.	743 Budde W.
3054 Boyd J.D.	1735 Bronner L.R.	1002 Budde W.
1680 Boynton R.M.	1316 Bronson II N.R.	2760 Budnitz R.J.
2665 Bozkov V.	1693 Brooks D.	1448 Budrikis Z.L.
2923 Bozoky L.	2069 Brooks G.A.	2820 Buecherl E.S.
3508 Braby L.A.	2111 Brooks R.	2822 Buecherl E.S.
1963 Brach E.J.	3233 Brooks S.	3113 Bugayev A.A.
3073 Bradley H.E.	1539 Brophy F.	2862 Bugdahl V.
288 Bradley J.L.	3598 Brophy P.D.	650 Bugliarello G.
655 Bradley W.E.	622 Bross D.S.	628 Buhrlen E.J.
914 Bradley W.E.	622 Bross I.D.J.	1293 Bukharov I.B.
47 Brady A.J.	1674 Bross M.	287 Bullen M.A.
2356 Brady F.P.	145 Brouha M.	2288 Bullitt M.K.
1603 Brady J.K.	1944 Brousseau R.	1380 Bulpitt C.J.
1 Brady J.M.	2540 Brower R.W.	2926 Bulpitt C.J.
2486 Brahn G.	63 Browman C.P.	321 Bunge R.G.
2607 Braid L.D.	2906 Brown B.H.	2940 Bunting P.S.
2608 Braid L.D.	1153 Brown B.J.	2229 Bunze V.
636 Braley S.	1087 Brown B.L.	2699 Burckhardt C.B.
646 Brand J.E.	3166 Brown B.L.	2900 Burckhardt C.B.
1145 Brand P.J.	1340 Brown B.W.	1139 Burden F.R.
3646 Branscomb A.B.	3474 Brown D.	936 Burdick C.K.
3646 Branscomb E.W.	2904 Brown I.M.	1277 Burema T.
1754 Brantley B.A.	319 Brown J.H.U.	247 Burger J.F.
2532 Brascho D.J.	3262 Brown J.H.U.	616 Burke G.
889 Brash J.L.	1755 Brown J.J.	2640 Burkhardt D.
484 Bratberg Sand A.	759 Brown J.P.	497 Burkley C.J.
3314 Brauer F.	2054 Brown K.S.	455 Burl M.
2444 Braun B.	2561 Brown K.S.	109 Burnett L.J.
1575 Braunstein R.	445 Brown L.	245 Burnham R.W.
72 Braunwald N.S.	3140 Brown M.	2458 Burns B.D.
691 Bray D.A.	2908 Brown M.C.	2722 Burrus C.S.
1697 Bray J.C.	3524 Brown M.S.	737 Burstein A.H.
1698 Breakey J.W.	3568 Brown O.R.	2053 Burton C.
1806 Brehme K.H.	354 Brown S.D.	3374 Burton R.M.
3559 Brehnan K.	576 Brown W.A.	1512 Burton W.M.
613 Breithardt G.	614 Brown W.A.	3121 Burton W.M.
2165 Brekelmans W.A.M.	1758 Brown W.A.	3651 Busch H.
1695 Brenke H.	189 Brown W.O.	2812 Buschmann W.
1325 Brennan P.K.	2857 Brownell W.E.	3141 Bush D.

2899 Bushong S.C.	3195 Carden E.	3217 Chaney Jr R.B.
10 Bussini A.	1346 Carey R.J.	1980 Chang C.C.
1388 Busmann W.D.	192 Carhart R.	2754 Chang D.B.
436 Butslov M.M.	1600 Carhart R.	1104 Chang H.K.
167 Buttermann G.	852 Carlon H.R.	1817 Chang H.K.
2803 Butti P.	2404 Carlson F.P.	874 Chang T.M.S.
3534 Butti P.	827 Carlson L.	1756 Chantalou J.P.
301 Buttner H.	2286 Carlson T.B.	1813 Chao E.Y.
1363 Button K.F.	1266 Carr P.W.	386 Chaplain R.A.
449 Butz B.P.	106 Carra W.M.	713 Chaplain R.A.
2590 Buunen T.J.F.	1588 Carrell J.C.	2189 Chaplain R.A.
3027 Byall E.B.	1081 Carrier S.C.	2196 Chaplain R.A.
684 Bycroft G.N.	1263 Carrington V.	1516 Chaplin G.B.B.
2831 Byer R.L.	503 Carroll A.S.	2834 Chapman E.D.W.
3655 Bykhovskii M.L.	2807 Carroll R.J.	2287 Chaput De Saintonge D.M.
956 Bystrov G.S.	515 Carstensen E.L.	1653 Chardon G.
2763 Bystrov G.S.	867 Carstensen E.L.	2460 Charles D.
	3153 Carstensen E.L.	2714 Charlesworth A.S.
3509 Cabeza L.	2090 Carter B.S.	1568 Charlson R.J.
1651 Cabler P.	1567 Carter D.R.	2854 Charmasson G.
2416 Caceres C.A.	2262 Carter S.A.	1720 Charyulu K.K.
2947 Caceres E.	2706 Carter W.H.	861 Chase R.
3480 Cadenel G.	3209 Cartwright R.F.	638 Chaturvedi M.C.
3439 Cagliuso G.	2546 Casasent D.	2307 Chaubey A.K.
638 Cahoon J.R.	345 Caserta G.	168 Chaudhuri N.
3283 Cahoon J.R.	3177 Cashman P.M.M.	705 Chavas A.
2740 Cain C.P.	2116 Caspi P.	2181 Chavas A.
2149 Caines P.E.	699 Casseday J.H.	3181 Chavatzas D.
1582 Cairns J.A.	3400 Cassel J.	3671 Chavdarov D.B.
64 Caldwell D.R.	1765 Cassell K.	846 Chaykina I.M.
3392 Caldwell D.R.	1669 Cassell K.J.	2639 Cheatham M.A.
1475 Callahan M.	85 Castor G.B.	1844 Cheetham B.M.G.
444 Callender A.B.	369 Castro P.E.	1829 Chelidze T.L.
589 Callesen C.	1875 Catalfo J.M.	1033 Chelsky M.
506 Calligaris F.	2251 Cathey W.T.	1193 Chen D.
2306 Calligaris F.	2854 Catier J.	2315 Chen F.S.
1801 Cambanis S.	2897 Causer D.A.	3378 Chen H.L.
327 Cameron H.V.	2921 Cavazza B.	3245 Chen R.
987 Cameron J.	2429 Caves P.K.	1464 Chen Y.
2441 Cameron J.N.	1264 Cember H.	3332 Chen Y.D.
2875 Cameron P.D.	1031 Cercek B.	961 Cheney J.A.
3069 Camm D.M.	1031 Cercek L.	334 Cheng D.K.
380 Campau D.N.	2784 Cerf E.	1452 Cheng L.C.
2428 Campbell D.E.	2784 Cerf J.A.	709 Chernavskaya N.M.
326 Campbell D.S.	855 Cermak J.	709 Chernavskii D.S.
2894 Campbell J.K.	855 Cernansky M.	1425 Cherneikin V.A.
3507 Campbell J.L.	506 Cernigoi C.	1128 Cherneykin V.A.
2434 Campbell R.L.	345 Cervigni T.	434 Chernyavskaya N.A.
1856 Campion P.J.	1799 Cervin V.B.	495 Chernyavskaya N.A.
1009 Canfield L.R.	297 Cevario S.J.	533 Cherrier F.
1073 Canfield T.R.	907 Cha C.C.	909 Cherruault Y.
3666 Cannom D.S.	2395 Chabay I.	2176 Cherruault Y.
2943 Cannon J.S.	1498 Chacko E.	3351 Cherruault Y.
2483 Canzoneri III J.	2806 Chadda K.D.	1469 Chetayev A.N.
567 Capel L.H.	1916 Chai D.T.	376 Cheung J.B.
1610 Caplan M.	2147 Chaitin G.J.	835 Chibalashvili Y.L.
672 Caplan S.R.	3230 Chakrabarty S.	3126 Chibrikhin V.M.
3292 Capobianco M.	3192 Chakrin L.W.	217 Chien Y.C.
1125 Capocelli R.M.	2505 Chalke R.	2518 Chik L.
890 Cappelen C.	599 Chamberlin D.D.	2519 Chik L.
1955 Cappellani F.	705 Chambron J.	1829 Chikaidze V.T.
2629 Capranica R.R.	2181 Chambron J.	3458 Chikira M.
2630 Capranica R.R.	806 Chan D.S.K.	477 Chikkur G.C.
3367 Capranica R.R.	2972 Chan H.S.	394 Childers D.G.
3601 Capranica R.R.	807 Chan W.C.	663 Childers D.G.
910 Caramazza A.	2374 Chandler K.C.	3377 Childers D.G.
2903 Carangi R.L.	1586 Chandler W.M.	957 Childress D.S.
910 Carbone E.	3022 Chandra R.	1176 Childs P.A.
1746 Card W.I.	3535 Chandra R.	2361 Chiles M.M.
969 Carden E.	2333 Chandross E.A.	367 Chin F.K.
2437 Carden E.	729 Chandross R.J.	201 Chin H.P.

1573 Chinnock E.L.	3579 Clement J.	705 Constantinesco A.
927 Chirkov V.V.	3492 Clement M.	2181 Constantinesco A.
3634 Chisholm L.A.	2494 Clement S.L.	640 Constantinescu C.
3652 Chiu S.	1278 Cleminshaw W.T.	1665 Cook C.C.
77 Chizmadzhev Y.A.	471 Clerbaux T.	2312 Cook C.S.
670 Chizmadzhev Y.A.	3096 Clerbaux T.	271 Cooke F.W.
671 Chizmadzhev Y.A.	3468 Clerbaux T.	570 Cooke F.W.
825 Chizmadzhev Y.A.	3549 Clevert D.	1701 Cool J.C.
1421 Chizmadzhev Y.A.	2435 Clevert H.D.	716 Cooley J.W.
2406 Chmiel H.	2825 Clevert H.D.	1251 Cooper F.S.
1841 Cho F.	2826 Clevert H.D.	2754 Cooper R.L.
1275 Chodorowicz M.	2827 Clevert H.D.	1843 Cooper W.F.
45 Chong K.P.	1597 Clopton B.M.	2643 Cooperman A.M.
3429 Chopra K.N.	1160 Cluck J.W.	3012 Cooperman A.M.
173 Chou K.	995 Clynes M.	1132 Cope F.W.
2852 Chou S.	742 Coates P.B.	2661 Cope F.W.
3225 Chouet B.A.	1095 Cobb L.A.	3069 Copley G.H.
3369 Chouvet G.	2891 Coble A.J.	739 Copping J.R.
316 Chow C.K.	243 Coderre J.	3149 Coppo M.
975 Chow C.K.	2916 Coe F.L.	381 Corcoran W.H.
1067 Chow C.K.	2189 Coenen R.	464 Corinth G.
1435 Chowanetz W.	1882 Cohen A.A.	747 Corinth G.
2041 Christiansen B.	118 Cohen D.	284 Cormack A.M.
1875 Christiansen C.F.	3325 Cohen D.N.	2336 Coron N.
2077 Christie A.D.	1929 Cohen E.	3212 Corrigan B.
1647 Christie D.	3266 Cohen H.I.	454 Corripio A.B.
3167 Christie Jr W.M.	2328 Cohen L.G.	2720 Corripio A.B.
2854 Christolomme A.	2746 Cohen L.G.	3452 Cosack U.
3073 Christopher C.J.	1438 Cohen R.E.	2267 Cosentino L.S.
3173 Christopher R.A.	1506 Cohen R.W.	1359 Cotter D.A.
3562 Christopher R.A.	1199 Cohen S.A.	3097 Cottin N.
726 Christy A.	2152 Cohn Sfetcu S.	2799 Cotton L.T.
3451 Chroust G.	3286 Cohn Sfetcu S.	1645 Coulson R.L.
355 Chu B.M.	63 Coker C.H.	1267 Coulter J.R.
794 Chu T.	2581 Colburn H.S.	2186 Coulter Jr N.A.
1819 Chuck L.	2617 Colburn H.S.	1638 Coulter T.W.
1559 Chulick E.T.	2201 Colburn T.R.	2032 Coulthard J.
1549 Chung P.L.	1095 Cole J.S.	3268 Coulthard W.J.
3204 Chuyeva I.V.	1134 Cole K.S.	3565 Couraud F.
1065 Cierkosz B.I.T.	773 Cole M.	2293 Courtin P.
506 Ciuti P.	1617 Coleman A.E.	1891 Courtney Pratt J.S.
2306 Ciuti P.	1372 Coleman C.	104 Cova S.
617 Clampitt S.	3438 Coleman L.W.	317 Covell J.W.
1684 Clapham P.B.	3513 Colenbrander A.H.	2282 Covington A.K.
2588 Clapper M.P.	2476 Colenbrander M.C.	720 Cowan J.D.
2724 Clapperton J.L.	1380 Coles E.C.	130 Cowan W.M.
2069 Claremont A.D.	2926 Coles E.C.	2038 Cowley R.A.
2475 Clark B.A.J.	614 Coles J.R.	3005 Cox Jr J.W.
813 Clark B.G.	1758 Coles J.R.	2834 Cox L.A.
3569 Clark C.	347 Coletti Jr J.M.	3570 Cox P.
2917 Clark D.E.	251 Collard E.W.	2676 Coyne M.B.
3563 Clark D.L.	2506 Collett J.H.	3062 Coyne M.B.
1652 Clark Jr J.W.	3038 Collins A.J.	191 Craig R.G.
2175 Clark Jr J.W.	1184 Collins F.G.	3502 Crandall J.R.
1452 Clark M.E.	911 Collins J.	2765 Crannell C.J.
1819 Clark S.	2651 Collins R.	3071 Cranshaw T.E.
155 Clark W.G.	3631 Collis J.M.	2479 Crapper D.
933 Clarke A.M.	2123 Colson W.B.	3191 Crawford G.
2744 Clarke D.	1250 Coltman J.W.	3025 Creasy D.E.
2949 Clarke D.	824 Colton J.S.	1403 Creecy R.
895 Clarke H.F.	1703 Comaish J.S.	1491 Creeseey D.R.
1872 Clarke J.	3210 Comis S.D.	3481 Cremer C.
3329 Clarke J.	837 Condit H.R.	3481 Cremer T.
2102 Clarke P.Z.	1229 Confer R.G.	2305 Creno R.J.
2503 Classen M.	1555 Connell P.N.	199 Crepeau R.L.
3530 Classen M.	2312 Conner W.D.	1759 Cress C.E.
3013 Clausen C.	222 Connor G.I.	339 Crippen G.M.
3016 Clausen C.	1123 Conrad M.	3014 Criswell H.E.
3017 Clausen C.	3594 Conrad M.	1162 Cronholm J.N.
2956 Claverie G.	3154 Conradi M.S.	2849 Cronin J.
1105 Clement J.	137 Constable R.L.	854 Cross B.P.

2587 Crossley J.J.	1251 David Jr E.E.	2274 Delsarte P.
2173 Crouzy R.	293 David R.M.	1436 Delsemme P.
3488 Crow J.D.	1282 David R.M.	1626 Deluigi B.
2491 Crow W.L.	1881 Davidsen P.S.	2978 Demetrius L.
3625 Crow W.L.	2023 Davidson C.L.	1857 Demyanova T.A.
468 Crowley J.M.	1604 Davidson G.A.	524 Demling L.
3589 Cruse H.	3190 Davies J.M.	765 Den Boef J.H.
3195 Crutchfield W.M.	3571 Davies J.M.	391 Denier Van Der Gon J.J.
2073 Crysler W.E.	1728 Davies N.J.	440 Denisyuk G.V.
2528 Csanady M.	2719 Davies N.R.	3430 Denisyuk G.V.
924 Csongradi J.	1481 Davies T.K.	501 Denman A.R.
1599 Cudahy E.	1416 Davio M.	2075 Depresseux J.C.
2585 Cudahy E.	2953 Davio M.	1888 Derosier R.M.
2598 Cudahy E.	1692 Davis E.E.	1379 Descamps B.
2615 Cudahy E.	2977 Davis Jr L.B.	3271 Descamps B.
2912 Cull P.	2671 Davison E.J.	2142 Deschamps J.P.
1406 Culter R.G.	3212 Dawes R.M.	2155 Deschamps J.P.
3663 Cumberbatch	2041 Dawids S.G.	2952 Deschamps J.P.
607 Cumberbatch J.	774 Dawson M.	3444 Descroix E.
2011 Cumberland J.H.	1685 Dawson W.W.	595 Despain R.R.
2211 Cunningham L.A.	2468 De Albuquerque Alves A.	443 Desvignes F.
3423 Cupal J.J.	1142 De Bakker J.M.T.	2783 Detering I.
1360 Curland S.	2035 De Bakker J.M.T.	944 Detwiler J.S.
432 Curry G.R.	2419 De Bellis F.	2283 Deuschle R.
3572 Curtis J.L.	3608 De Boer B.	2270 Deverell J.
305 Curtis M.A.	2842 De Buyl M.	10 Di Raffaele R.
504 Curtis M.A.	1990 De Carlos J.E.	1399 DiCenzo C.D.
605 Curtis M.A.	3472 De Cock C.A.	3523 DiMaio T.
1 Cutright D.E.	3567 De Courcy A.	1723 DiMeo F.N.
3327 Cuypers J.G.M.	2522 De Dombal F.T.	2790 DiSimoni F.G.
1186 Czerlinski G.	3258 De Dombal F.T.	2791 DiSimoni F.G.
3299 Czerlinski G.H.	1063 De Duca C.J.	1543 Diana J.N.
1999 Czirr J.B.	1966 De Giorgio A.	2049 Dicara L.V.
	1756 De Heaulme M.	2418 Dick W.
2250 Daab P.	1757 De Heaulme M.	319 Dickson III J.F.
1335 Daams J.L.C.	3272 De Jong R.H.	569 Dickson J.H.
2413 Dabolt L.	827 De Josselin De Jong J.E.	880 Didry J.R.
1555 Dahl C.F.	809 De Kroes J.L.	1980 Diener E.M.
251 Dahlin G.C.	727 De Lange J.C.	1090 Diercks K.J.
603 Dahlmann K.	2566 De Lorenzo L.J.	130 Dierker M.L.
3453 Dahlquist F.W.	1532 De Mey G.	865 Diestel H.G.
997 Dahnert K.	361 De Mori R.	948 Diestel H.G.
404 Daigle R.E.	1902 De Neumann B.	1588 Dieterly D.K.
3675 Dalby B.C.S.	1335 De Pauw A.D.M.	1695 Dietrich L.
3373 Daley M.L.	1696 De Porras A.	2016 Dietsch G.
1192 Dalisa A.L.	3580 De Rezende J.	2819 Dietz H.
2639 Dallos P.	1794 De Rocco A.G.	541 Dijkema F.K.
3523 Damadian R.	546 De Vecchi A.	842 Dillon J.A.
937 Damle P.S.	391 De Vos Burchart R.M.	1244 Dillon J.A.
1169 Damljanovic D.D.	573 De Vries K.L.	1762 Dillon T.S.
2291 Dandliker R.	3669 De W. Vivier C.	1855 Dimeff J.
1426 Danielson D.A.	2180 De Wit B.	3633 Dimeff J.
3444 Daniere J.	200 DeBakey M.E.	1894 Dimri A.K.
2308 Danilov V.A.	3180 DeBakey M.E.	3163 Dimri G.P.
2425 Dannenberg H.	1192 DeBitetto D.J.	2919 Dinand J.P.
2612 Danner W.F.	861 DeCaprio A.	1804 Dinstein I.
2640 Darnhofer Demar B.	1827 DeHaven J.C.	883 Dinwiddie R.
108 Das G.	1610 DeNoble V.	2753 Diotte M.P.
1478 Das G.	595 DeVries K.L.	691 Dirks D.D.
802 Das P.K.	1719 DeWerd L.A.	1082 Dirks D.D.
108 Das S.K.	1422 Deakin M.A.B.	894 Dittberner K.H.
1478 Das S.K.	10 Dean A.J.	3442 Dittmann J.
2234 Dascalov I.C.	966 Dean P.N.	897 Dittmar H.A.
3671 Dascalov I.K.	2802 Debacker G.	3252 Divell S.S.
2557 Dashevsky V.G.	2918 Decker D.	2612 Divenyi P.L.
294 Datta A.K.	428 Decker J.R.	228 Dixon N.R.
329 Daugherty J.D.	1118 Defares J.G.	3545 Dixon P.R.
554 Daugherty J.H.	2919 Defayolle M.	2440 D'Angelo E.
2121 Daugherty T.W.	897 Degenring F.H.	2797 D'Antoni L.
1196 Davall P.W.	2802 Degre S.	2338 Djordjevic Z.
3053 Davey P.G.	426 Dekold D.F.	119 Djordjevich B.Z.

2980 Djupesland G.	2671 Duffin J.	
378 Dmitriyev V.L.	3405 Duffin Jr E.G.	
3123 Dmitriyevskiy O.D.	1700 Duggan T.C.	
1223 Dobbs G.M.	2982 Duifhuis H.	
2413 Dobbs J.	2526 Duisterhout J.S.	
923 Dobelle W.H.	461 Dujardin J.P.	
2477 Dobelle W.H.	246 Dukes K.D.	
3199 Dobelle W.H.	745 Dumler G.Y.	
1073 Dobrin P.B.	1148 Dumler G.Y.	
1076 Dobrin P.B.	1968 Dunayev A.S.	
3093 Dobson J.V.	2321 Dunayev A.S.	
716 Dodge Jr F.A.	424 Dunbar C.	
127 Doi K.	29 Duncan R.C.	
480 Doladugina V.S.	2433 Dundee J.W.	2905 Edland R.W.
3634 Dolan A.M.	1686 Dunipace D.W.	2580 Edman K.A.P.
1060 Dolan F.G.	2006 Dunlop J.	1278 Edmark K.W.
2618 Dolan T.R.	867 Dunn F.	2048 Edmonds H.L.
2677 Dolfin J.	1603 Dunn F.	1292 Edmunds Jr L.H.
2664 Dolowy K.	2891 Dunn F.	3155 Edson A.P.
692 Domnitz R.	573 Dunn H.K.	1203 Edwards C.
950 Donaldson P.E.K.	2344 Duret C.	2925 Edwards D.N.
2453 Donaldson P.E.K.	3253 During H.	1516 Edwards J.H.
1228 Donato R.J.	35 Durlach N.I.	1198 Edwards J.R.
1232 Donato R.J.	3068 Durrani T.S.	2828 Effert S.
2293 Doncieux C.	2880 Durrant J.D.	3667 Effert S.
2429 Dong Jr E.	1451 Duruble M.	1724 Eggermont G.
1147 Donovan J.C.	342 Dutrannois J.R.	2061 Eggermont J.J.
2637 Dooling R.J.	3636 Dutta B.N.	3026 Ehnolm G.J.
2777 Dooling R.J.	802 Duttagupta R.	106 Ehret J.E.
1296 Dorman R.G.	1292 Dutton R.C.	3400 Eibling D.
487 Dorofeyeva M.V.	3358 Dutton R.E.	630 Eichmeier J.
1182 Dorokhov B.Y.	1451 Duvelleroy M.	3392 Eide S.A.
2078 Dos Santos M.C.M.	2177 Duvelleroy M.A.	2995 Eidelman G.I.
2390 Dossetor J.B.	1254 Duxbury A.J.	3136 Eisen Y.
1633 Doty R.L.	2686 Dwyer A.F.	3013 Eisenberg R.S.
335 Doubleday W.G.	2276 Dwyer J.C.	3016 Eisenberg R.S.
799 Douce J.L.	1515 Dyer D.L.	3017 Eisenberg R.S.
1196 Douce J.L.	3152 Dyson M.	1736 Eisenhauer P.
3273 Dougherty R.	1924 Dziggel K.P.	2097 Eisold E.
1149 Dove R.C.	3478 Dzvonik M.J.	2114 Ekstedt J.
148 Dowd G.		3588 Ekstedt J.
3315 Dowdee J.W.	1918 Earley J.	779 Ekstrom M.P.
3668 Dower G.E.	3197 Earon J.	371 Elachi C.
497 Downing C.P.	1054 Easton T.A.	3432 Elembayev Y.N.
1076 Doyle J.M.	2502 Eastwold E.L.	2291 Eliasson B.
1822 Drabkin R.L.	1051 Ebara T.	3615 Eliasson S.
1483 Dragotinov A.	1236 Ebbing C.E.	2182 Eliezer N.
3268 Drance S.M.	2304 Eberhard P.	2443 Eliezer N.
1621 Dransfield B.S.	2788 Eberhardt G.	2106 Elings V.
1974 Draper D.	2804 Ebnetter Schwitter H.	1293 Elkin L.I.
940 Drash P.W.	1767 Echallier J.F.	516 Elpiner I.Y.
1351 Drennon G.G.	1396 Eck C.F.	350 Elkin A.P.
1378 Drennon G.G.	2016 Ecker E.	150 Ellen L.W.
167 Dressler J.	1562 Eckerle K.L.	189 Elliott A.R.
2870 Drettner B.	2641 Eckert H.	3678 Elliott D.
3284 Driessens F.C.M.	3560 Eckstein R.W.	3558 Elliott R.
829 Drikker T.S.	1366 Eddleman Jr E.E.	1259 Ellis R.A.
1930 Driller J.	3593 Eddy L.B.	1607 Elterman L.
2944 Drobnik J.	2183 Edgerton R.H.	1839 Elul R.
1451 Droulez J.		541 Elzinga G.
1444 Drucker H.		2179 Elzinga G.
916 Drummond K.N.		2311 Emelyanov V.B.
1150 Drzewiecki T.M.		3678 Emery A.E.H.
3472 Ducardus R.		2331 Ems S.C.
3169 Duchting W.		1011 Enderlein G.
1301 Ducker T.B.		3233 Endicott D.
519 Duckworth E.M.		1227 Endres G.W.R.
309 Ducrot H.		3658 Endres L.
3610 Dudkin K.N.		616 Enenstein J.
435 Dudnikov Y.A.		3109 Eng S.T.
846 Dudnikov Y.A.		2405 Engel A.

985 Engelbrecht R.	3079 Farrow H.M.	2640 Fischer K.
3499 Engelsberg M.	3277 Farvis K.M.	3659 Fischer M.
819 Enger H.	1000 Fassler K.	449 Fischl R.
538 Enghoff E.	1157 Faulkner E.A.	2420 Fiser B.
3420 Enjelvin M.	3511 Faust J.	3232 Fisher G.L.
3304 Eno B.E.	3532 Faxvog F.R.	608 Fisher M.
373 Enoch J.M.	561 Fay R.R.	708 Fishman H.M.
1825 Enoch J.M.	3565 Fayet G.	36 Fishman S.N.
680 Eory A.	3480 Fayolle R.	724 Fishman S.N.
2918 Epple E.	1754 Feagin S.J.	1128 Fishman S.N.
2298 Epstein M.	282 Feddema Gorissen A.	1425 Fishman S.N.
196 Eradus W.J.	1182 Fedorov B.F.	2215 Fisk G.A.
2923 Erdelyi K.	2311 Fedorova I.S.	1657 Fitch A.H.
390 Eremia D.	2059 Fedorova N.S.	1938 Fitton G.L.
1297 Ergun S.	2681 Fedotov O.M.	3263 Fitzgerald L.T.
1407 Erickson B.K.	1303 Feher O.	1611 Fitzgerald M.J.T.
2852 Erickson D.	580 Fehrentz D.	1733 Fitzgerald W.F.
2439 Erickson J.C.	2611 Feigel L.J.	1134 Fitzhugh R.
2502 Erickson J.J.	1909 Feigt I.	1391 Fitzpatrick E.L.
2034 Eriksson R.	808 Feinstein A.R.	1597 Flammino F.
227 Erman L.D.	3261 Feinstein A.R.	2838 Flanagan J.L.
3252 Ernst E.A.	2386 Feinstein S.H.	891 Flax S.W.
925 Esashi M.	3353 Felder R.M.	974 Fleck A.
1552 Esashi M.	392 Feldman J.F.	920 Fleck W.
3586 Eschbach J.W.	3108 Felici C.	399 Fleischer P.E.
2326 Escobar D.E.	1159 Felix W.D.	907 Fleming D.
237 Eskelinen P.	1831 Feld B.N.	584 Fleming L.W.
1679 Esser G.	3411 Fell R.B.	1368 Fleming N.I.
1607 Essex J.O.	3418 Fell R.B.	3074 Fleming R.N.
575 Esslinger J.O.	3032 Fellmann S.	1350 Fletcher J.D.
981 Etevenon P.	3115 Felsen L.B.	2423 Fletcher J.R.
1177 Eto Y.	2629 Feng A.S.	2970 Fletcher L.S.
2224 Eulenberg H.P.	2630 Feng A.S.	1180 Flory R.E.
754 Evangelisti F.	1392 Fenna D.	2395 Flygare W.H.
669 Evans E.A.	744 Fenster A.	3119 Flynn P.T.G.
882 Evans E.A.	839 Fenster A.	721 Fohlmeister J.F.
3037 Evans F.C.	903 Fenton T.R.	3307 Foias C.
1820 Evans F.G.	3195 Ferguson G.B.	1459 Fokin V.F.
2576 Evans F.G.	176 Ferran R.J.	1832 Fokin V.F.
419 Evans W.A.	1163 Ferrie R.	2998 Fokkens J.K.
697 Evans W.E.	2921 Ferrillo F.	3189 Folgering H.T.
1090 Evans W.E.	2590 Festen J.M.	1687 Folk R.L.
3676 Evens R.G.	1633 Fester K.	3506 Folkmann F.
1212 Everson R.W.	2613 Feth L.L.	2208 Folomeyev A.V.
1706 Ewen K.	2299 Feucht P.	2067 Fomin S.V.
2867 Ewert J.P.	365 Feygel V.I.	3620 Fomin S.V.
1555 Ewy G.A.	512 Fiala W.	3219 Fonda G.
1555 Ewy M.D.	2276 Fichter H.	1273 Fontaine G.
118 Eylon S.	602 Fichtner F.	3574 Fontana R.S.
3486 Eyring E.M.	3070 Fielden C.J.	2253 Fontani P.
	3058 Filimonov R.P.	3086 Foord R.
	3433 Filimonov R.P.	1432 Foote G.B.
2253 Fabeni P.	853 Filippov O.K.	512 Foote Jr H.L.
629 Fabian J.	156 Filler A.S.	2864 Forbes M.
2516 Fackler D.	3343 Finch E.D.	2561 Forbes W.F.
3240 Fahey L.J.	2063 Findlay J.M.	500 Forcinal G.
641 Fairhurst C.W.	153 Fink D.	3067 Fordan G.
533 Faivre G.	1977 Fink R.W.	1572 Forno C.
1509 Falconer D.G.	3132 Fink R.W.	3110 Forno C.
3049 Falconer D.G.	403 Finkelshteyn Y.I.	3072 Forrer J.
3615 Falk J.E.	1899 Finkelshteyn Y.I.	3500 Forrer J.
661 Fallside F.	1710 Finkenzeller J.	1063 Forrest W.J.
2807 Falsetti H.L.	2515 Finney D.J.	3151 Forrester J.A.
3676 Falvey N.J.	3503 Finsy R.	2080 Forstbauer W.
1439 Fan L.T.	1001 Firkins J.H.	3298 Forthofer R.N.
1104 Farhi L.E.	3093 Firman R.E.	2446 Foster D.H.
154 Farmer J.B.	560 Fischbarg J.	2450 Foster D.H.
2305 Farrand J.	3552 Fischell R.E.	3343 Foster K.R.
2037 Farrell E.J.	1318 Fischer B.	1314 Foust K.O.
343 Farrell P.C.	2653 Fischer B.	169 Fowler I.L.
3586 Farrell P.C.	2672 Fischer C.F.	3403 Fowler L.
3675 Farrer J.A.		

3670 Fox B.H.	383 Fu B.S.	287 Garrett J.A.
1619 Fox J.E.	634 Fu J.C.	3098 Garrett W.R.
2455 Fox J.L.	3267 Fuchs G.	2486 Garrison A.F.
814 Fox J.R.	3484 Fuenfschilling J.	3279 Garvitch Z.S.
1795 Fox M.A.	2483 Fuhrer M.J.	1772 Gashler R.J.
608 Fox R.I.	1815 Fujimasa I.	1108 Gassee J.P.
1811 Fozzard H.A.	2531 Fujimura O.	666 Gatewood L.C.
3612 Fraenkl G.	2362 Fukida K.	1091 Gatling L.W.
176 Fraim F.W.	1704 Fukui K.	3187 Gattozzi J.G.
1254 Frame J.W.	489 Fukumoto A.	299 Gau J.
268 Franceschini V.	2979 Fuller C.A.	982 Gaudeau C.
513 Francey R.J.	970 Fulmek R.	2326 Gausman H.W.
2036 Francis G.R.	1267 Fulwyler M.J.	3626 Gauthier P.
3165 Franetzki M.	431 Funahashi K.	3610 Gauzelman V.Y.
3202 Franetzki M.	1890 Funahashi K.	1222 Gavalas Medici R.J.
682 Frank G.M.	1740 Funding L.	1472 Gavrilovic J.
2498 Frankenberg D.	1074 Fung Y.C.	2646 Gaylor J.D.S.
3260 Franklin D.A.	1075 Fung Y.C.	2514 Gaynon P.S.
2973 Frankus A.	2971 Fung Y.C.	2765 Gearhart R.A.
471 Frans A.	535 Funke H.D.	194 Geddes L.A.
1269 Franz G.N.	1187 Funnell W.R.J.	1638 Geddes L.A.
3260 Fraser P.M.	1636 Furman S.	1639 Geddes L.A.
2025 Frasher W.G.	2739 Furman S.A.	1651 Geddes L.A.
2863 Fraunfelder F.T.	845 Furtova A.Z.	3176 Geddes L.A.
2482 Frediani C.	3002 Furukawa T.	3566 Geddes L.A.
413 Freeman A.R.	3362 Furukawa T.	3388 Geddie J.C.
824 Freeman A.R.	2819 Furuse M.	2995 Gedevasi D.M.
2795 Freeman F.J.	3512 Furuta Y.	1516 Gedye J.L.
474 Freeman J.H.	1197 Fuss P.S.	3287 Geen J.A.
2391 Frei R.W.	191 Fuys R.A.	952 Geeraets W.J.
1924 Freitag W.	641 Fuys R.A.	2626 Geesa B.H.
1394 French A.S.	1245 Fymat A.L.	3420 Geier S.
3404 French A.S.		1743 Geisler S.
2838 French J.C.	2528 Gaal T.	3191 Gelb A.
2728 French M.L.V.	3506 Gaarde C.	384 Gelbrich D.
110 Freris L.L.	531 Gabelnick H.L.	2010 Gelbwachs J.
938 Frettay C.	2300 Gabriel M.	3134 Gelius U.
2439 Freundlich J.J.	2365 Gabriele S.A.	719 Gelfand I.M.
1285 Friauf W.S.	2372 Gabriele S.A.	1306 Gelfand I.M.
1663 Friauf W.S.	2306 Gabrielli I.	618 Gell G.
2747 Fried J.	2991 Gabrielsson A.	1084 Gengel R.W.
2961 Fried J.	1773 Gad H.	1314 Gengel R.W.
1739 Frieden C.	3369 Gadea Ciria M.	255 Genin J.
1392 Friedenberga L.W.	2712 Gagulin V.N.	1751 Gennaro G.
1156 Friedenson R.A.	2936 Gaikhorst G.	929 George F.H.
619 Friederichs H.	2201 Gainer H.	2416 George M.E.D.
3410 Friedl W.	266 Galante J.	1457 Gerasimov V.E.
1327 Friedman H.	352 Galante J.O.	471 Gerets G.
2084 Friedman J.	353 Galante J.O.	1620 Gerhard Jr F.B.
209 Friedman J.J.	3128 Gale B.N.	215 Gerhardt T.
668 Friedman M.H.	851 Galtsev A.P.	1668 Gerken G.M.
786 Friedmann G.B.	827 Galjaard H.	880 German A.
1928 Friedrich G.	3164 Gallagher R.R.	456 Germann R.H.
2535 Fries B.E.	1205 Gallasch G.	265 Germanton D.
1511 Frisen L.	1291 Gallup A.L.	798 Gersch W.
1322 Fritze W.	1871 Galpin G.S.	1240 Gershoy A.
889 Fritzinger B.K.	1363 Gambino S.R.	3576 Gertner J.
893 Frobenius W.D.	1271 Ganascia Goetschel J.	1628 Geselowitz D.B.
218 Frohlich J.	472 Ganfield R.A.	1743 Gettner U.
1566 Frolova N.P.	3230 Ganguli S.	760 Ghelfan P.
628 Frost H.	1447 Ganiel U.	3644 Ghezzo F.
3111 Frostling H.	835 Gaprindashvili K.I.	47 Ghista D.N.
3529 Fruehmorgen P.	793 Gara A.D.	1428 Ghista D.N.
524 Fruhmorgen P.	680 Garamvolgyi N.	2650 Ghista D.N.
2503 Fruhmorgen P.	2831 Garbuny M.	2753 Ghosh S.K.
2783 Fruhstorfer H.	3684 Garcia C.A.	506 Giacomich R.
2074 Fry E.K.	1756 Garcon C.	2306 Giacomich R.
2893 Fry W.H.	2582 Gardner M.B.	1161 Giaimo Jr E.C.
295 Fryer T.B.	3045 Gardner R.M.	2113 Giaquinto S.
427 Fryer T.B.	1040 Garfinkel D.	1914 Gibson T.A.
3416 Fryer T.B.	1958 Garfinkel S.B.	136 Gidl G.

2213 Gieles A.C.M.	2583 Goldstein J.L.	1990 Granados C.E.
3401 Gies J.	2868 Goldstein J.L.	1657 Granatstein V.L.
2735 Gigante J.R.	1005 Goldstein L.H.	2699 Grandchamp P.A.
526 Gilbert B.N.	553 Goldstein P.J.	2900 Grandchamp P.A.
491 Gilevich I.G.	2742 Goldstein R.J.	3463 Grande P.O.
799 Gill J.M.	230 Goldstein S.R.	2861 Grandjot W.
1294 Gille J.P.	949 Goldthwaite D.	945 Granger E.M.
1572 Gillham E.J.	3642 Golender V.E.	674 Granik G.
51 Gilliom J.D.	2758 Gollnick D.A.	3039 Grannell P.K.
428 Gillis M.F.	2395 Gollub J.P.	567 Grant B.J.B.
2606 Gillmann R.A.	1260 Golovachev A.F.	1208 Grant H.
174 Gilmore R.S.	2751 Golyandin N.S.	2161 Grant P.G.
336 Gilpin M.E.	2832 Gomes O.M.	3619 Grant Sidwall H.
648 Ginsburg E.H.	2987 Gondra M.I.	1502 Granzer W.
1100 Giordano T.A.	1393 Gonen B.	1034 Grasman J.
3578 Giroud M.M.	2947 Goni A.J.	731 Grassberger P.
3590 Girton D.G.	2344 Gonord P.	3547 Grauerholz H.
2477 Girvin J.P.	1001 Gooch C.H.	1736 Grael E.H.
2365 Giusti P.	458 Goodacre J.B.	2130 Gravely B.T.
2372 Giusti P.	1046 Goodall M.C.	2555 Gravely B.T.
2942 Givens S.	250 Goode R.L.	66 Graves D.J.
955 Gjelsvik A.	2586 Goodenough D.J.	3080 Graves K.W.
3223 Gjotterberg M.	2597 Goodfellow G.L.	1540 Gray Jr A.H.
583 Glaeser L.	1777 Goodman A.M.	2989 Gray Jr A.H.
1551 Glanzman D.L.	3319 Goodrich L.M.	2899 Gray P.M.
766 Glarum S.H.	303 Goodrich R.M.	3339 Gray R.J.
17 Glass L.	3076 Goodwin J.M.	1334 Grechanik L.A.
19 Glass L.	3101 Goodyear C.C.	987 Green D.K.
2899 Glaze S.A.	1895 Gopshteyn N.M.	1092 Green D.M.
1375 Gledhill V.X.	2081 Gorban A.M.	513 Green D.W.
1752 Gledhill V.X.	438 Gorbunov G.G.	1904 Green W.L.
613 Gleichmann U.	847 Gorbunova M.D.	32 Greenberg M.D.
2816 Gleichmann U.	755 Gordon E.I.	2028 Greenfield Jr J.C.
951 Gleizer S.I.	101 Gordon Jr M.J.	1291 Greenwood B.
2643 Glezer V.D.	2089 Gordon M.	1345 Greenwood Fimlt D.
3204 Glezer V.D.	3440 Gordon S.	3216 Greer M.H.
3638 Glimcher M.J.	2500 Gore W.G.	622 Gregory A.R.
1049 Gliozzi A.	2004 Goreczky L.	1891 Gregory R.L.
3425 Globus G.	861 Gorenstein P.	2862 Greguss P.
1573 Gloge D.	1261 Gorisch W.	1374 Greist J.H.
1817 Glomski C.A.	2047 Gorisch W.	309 Gremy F.
1322 Gloning K.	436 Gornostayev V.A.	1369 Gremy F.
3279 Glover A.J.	2749 Gorodinskiy G.M.	2358 Grench H.A.
3470 Glover J.L.	1506 Gorog I.	2336 Grenier P.
314 Gluckman J.C.	3433 Gorokhovskiy Y.N.	2966 Grenoble D.E.
933 Glue L.C.T.	2885 Gorozhanin V.S.	240 Grether C.B.
1259 Glynn B.D.	1402 Goser K.	1471 Grevesse N.
2214 Gobiet W.	2620 Goshorn E.	1759 Grewal T.
2382 Godfrey B.W.	1574 Gosting L.J.	3446 Grianti F.
2478 Godina T.Y.	168 Goswami B.	2102 Griem M.L.
378 Godovskiy M.I.	238 Gott A.H.	1249 Griffin D.R.
1565 Goell J.E.	3626 Gottesmann C.	3275 Griffith J.M.
3312 Goh B.S.	658 Gottinger H.W.	1994 Grigorescu L.
2219 Gokyu T.	3293 Gottinger H.W.	1044 Grigorev P.A.
2027 Gold A.C.	2566 Gottlieb P.	1157 Grimbleby J.B.
1346 Gold R.M.	3202 Gottschaldt M.	44 Grimm A.F.
3502 Goldberg I.B.	2124 Gottwald A.	3397 Grimmert H.
2283 Goldberg J.	2681 Gottwald A.	34 Grindey G.B.
981 Goldberg P.	2261 Gough P.T.	1089 Grinnell A.D.
1369 Goldberg P.	2931 Goupy F.	828 Grishko M.I.
2175 Golden J.F.	3130 Gourdon J.C.	1271 Griton P.
1611 Golden J.P.	2289 Goutier D.	217 Grob D.
3185 Golden Jr D.P.	3490 Graber M.A.	126 Grodnikov A.I.
1095 Golden R.D.	847 Gradoboyev V.M.	3485 Groft J.
640 Goldenblum A.	1476 Graeme J.	2864 Grolman B.
1493 Goldfarb W.	3409 Graeme J.	3048 Grosch A.
3188 Golding H.J.	1522 Graham H.M.	2495 Gross B.
496 Goldman A.	2723 Graham N.Y.	2648 Gross D.R.
2633 Goldman L.R.	2572 Grahn A.R.	1004 Gross J.
3232 Goldman M.	2428 Grais I.M.	1810 Gross J.F.
1110 Goldsmith H.L.	481 Grammatin A.P.	37 Grossberg S.

1737	Grosser K.	1081	Hafter E.R.	3051	Haralick R.M.
758	Grosskopf R.	972	Hagamen W.D.	3010	Harary H.
2214	Grote W.	3301	Hagander P.	1703	Harborow P.R.H.
1233	Groves Jr I.D.	791	Hagedoorn A.	1927	Harbrink H.
1971	Grovum W.L.	2383	Hagemann H.	1326	Hardie D.I.
2563	Gruber C.	2765	Hagen F.A.	1737	Hardieck J.
3072	Gruber K.	421	Hagenbeuk H.	2345	Hardin J.
3500	Gruber K.	2869	Haggard M.P.	3687	Harding T.H.
890	Grundahl H.	2634	Hahn P.	3533	Hardison W.G.M.
1900	Grunhagen H.H.	872	Haimes Y.Y.	82	Hardy J.C.
1628	Grynszpan F.	1029	Hajek P.	930	Hardy W.L.
3333	Gubina F.	686	Haken H.	931	Hardy W.L.
2331	Gucker F.T.	1304	Hakumaki M.O.K.	3300	Hare D.K.
2034	Gudmundsson B.	2232	Halbedl G.	3218	Harford E.
2488	Gueguen C.	414	Halder N.	870	Harford K.D.
3072	Guenthard H.H.	291	Hale R.	677	Harkness M.L.R.
3575	Gueveler C.	2351	Halfon M.	677	Harkness R.D.
2767	Guibarra E.J.	367	Halford J.H.	1351	Harless W.G.
610	Guisan M.	616	Halko A.	1378	Harless W.G.
2366	Gulakov I.R.	1951	Hall H.P.	603	Harm K.
661	Gulamhusein M.N.	1096	Hall J.L.	1029	Harmancova D.
2844	Gullberg C.A.	2122	Hall S.J.	1935	Harmathy T.Z.
1343	Gundersen J.	3222	Hallden U.	1760	Harper R.M.
3378	Gundjian A.A.	3218	Hallen O.	449	Harper T.R.
1101	Gunn J.E.	1677	Hallgren R.	916	Harries J.D.
700	Gunn W.J.	1837	Hallgren R.	78	Harrington L.
2243	Guntersdorfer S.	2887	Hallin G.	569	Harrington P.R.
3500	Gunthard H.H.	2767	Halliwell M.	412	Harrington W.D.
1797	Gupta A.K.	2770	Halliwell M.	861	Harris B.
2307	Gupta H.V.	394	Halpeny O.S.	502	Harris D.W.
2209	Gupta J.S.	2712	Halpern A.D.	1210	Harris E.A.
3163	Gupta J.S.	844	Halpert H.	2737	Harris J.H.
2966	Gupta K.K.	952	Ham Jr W.T.	3075	Harris K.R.
750	Gupta M.L.	1376	Hamacher M.	2836	Harris K.S.
1027	Gupta N.K.	1753	Hamacher M.	990	Harrison D.C.
2951	Gupta N.K.	1152	Hamaoui M.	3000	Harrison D.C.
13	Gupta R.S.	1606	Hamburg J.A.	3568	Harrison D.C.
14	Gupta R.S.	1672	Hamernik R.P.	3666	Harrison D.C.
3009	Gurel O.	2587	Hamernik R.P.	1855	Harrison D.R.
962	Gurfinkel V.S.	2636	Hamernik R.P.	1644	Harrison E.C.
2067	Gurfinkel V.S.	2879	Hamernik R.P.	263	Harrison G.A.
1660	Gurk C.	592	Hamilton L.H.	1201	Harrison L.W.
3592	Gurk C.	973	Hamilton W.F.	3217	Harrison R.
2205	Gurley L.R.	3405	Hamilton W.G.	2928	Harrison W.K.
469	Gushchin I.S.	342	Hamm R.N.	757	Hart B.L.
2281	Gustafsson L.	2304	Hammacher K.	2685	Hart B.L.
980	Gustafsson T.	1201	Hammes G.G.	3044	Hart B.L.
3210	Guth P.S.	1754	Hammond W.E.	3068	Hart C.G.
2994	Gutman S.R.	525	Hamner III J.E.	2134	Hart H.E.
1146	Guttner W.	2317	Hampshire M.J.	918	Hart J.B.
2318	Guy A.W.	1362	Han K.S.	2728	Hart J.B.
2342	Guy A.W.	260	Hankins J.D.	158	Hart P.B.
3036	Guzelbayev Y.Z.	2684	Hanna N.N.	711	Harth E.
1751	Guzzardi R.	74	Hanna W.T.	464	Harth O.
1508	Gvosdover R.S.	1649	Hanna W.T.	2329	Hartley D.L.
2082	Gwiazdowska B.A.	1650	Hanna W.T.	2415	Hartung C.
1554	Gydikov A.	3035	Hanneman H.W.	3196	Hartung M.
		2850	Hansebout R.	338	Hartwig F.
1587	Haack K.	27	Hansell R.I.C.	3086	Harvey A.E.
623	Haak D.	1977	Hansen J.S.	3675	Harvey P.W.
2711	Haas O.E.	2042	Hansen S.	2029	Hasegawa T.
2003	Habal M.B.	3247	Hansen S.	2394	Haselkorn D.
3436	Habel F.	482	Hansen W.N.	1397	Hasili J.P.
1736	Habermehl A.	1376	Hansmann M.	290	Haskard D.L.
3587	Hachet T.	1495	Hanson J.V.	2258	Haskell B.G.
2013	Hacke M.	1873	Hanson J.V.	1726	Haslam K.R.
244	Haddad G.M.	2793	Hanson R.J.	1512	Hatter A.T.
3309	Hadeler K.P.	2732	Hanss M.	3121	Hatter A.T.
3347	Hadeler K.P.	2203	Hara K.I.	357	Hatze H.
2251	Hadwin J.F.	2021	Hara Y.	2414	Hauber M.E.T.
1993	Hadzisehovic M.	1804	Haralick R.M.	2426	Hauber M.E.T.

3546 Hauber M.E.T.	2782 Henderson M.R.	2329 Hill R.A.
3564 Hauber M.E.T.	3470 Henderson M.R.	3676 Hill R.L.
2608 Haughey P.J.	2622 Henderson T.L.	1263 Hill R.S.
904 Hauss W.H.	1365 Hengeveld S.J.	1464 Hill T.L.
726 Hausser O.	2526 Hengeveld S.J.	3332 Hill T.L.
233 Hawk Jr J.W.	3178 Hengeveld S.J.	3642 Hiller S.A.
2350 Hawk R.M.	2840 Henke W.L.	3605 Hillman P.
1406 Hawken K.W.	1231 Henley D.C.	2644 Hills B.A.
1286 Hawkins C.M.	2280 Henning G.	785 Hines D.E.
2247 Hawksford M.J.	1446 Henning G.B.	1785 Hini P.
2042 Hay D.M.	3454 Henrichsen R.E.	3505 Hinsch H.
2536 Hayashi R.	120 Henriksen J.K.C.	998 Hintz K.J.
286 Haybittle J.L.	3615 Henrikson C.O.	3554 Hinz R.
448 Hayes A.M.	2178 Henry A.F.	2698 Hirano M.
1406 Hayes R.	3413 Henry J.P.	1141 Hirche H.
3249 Hayhurst J.W.	3414 Henry J.P.	298 Hirl J.C.
1349 Hayt D.B.	3275 Henry W.L.	2931 Hirl J.C.
2335 Hayward G.C.	1743 Henskes D.T.	2839 Hirose H.
3147 Haywood B.C.G.	2633 Henson Jr O.W.	2841 Hirose H.
1256 Hazen B.	3522 Hepburn H.R.	351 Hirsch C.
911 Head L.R.	213 Herbert W.J.	990 Hirsch M.
1297 Headrick A.	1477 Herbst L.J.	2309 Hirschfeld T.
2088 Healy M.J.R.	3231 Herbst M.	53 Hirsh I.J.
2511 Healy M.J.R.	3316 Hering H.	2618 Hirsh I.R.
3652 Healy M.J.R.	1909 Hering W.	504 Hiruta K.
607 Heaps H.S.	450 Herman G.T.	2411 Hinstead M.B.
3663 Heaps H.S.	1884 Herman G.T.	2706 Ho P.C.
654 Hearon J.Z.	3447 Herman G.T.	3618 Hoaglund F.
3354 Hearon J.Z.	3178 Hermans M.	3619 Hobson D.A.
3455 Hearrell L.R.	2381 Hermsdorf D.	2416 Hochberg H.M.
2401 Heath J.R.	2434 Herrera N.	46 Hochmuth R.M.
3412 Hechtman H.B.	1102 Herrick R.M.	3171 Hochmuth R.M.
3548 Hechtman H.B.	1952 Herrmann H.D.	3605 Hochstein S.
248 Hecker M.H.L.	1960 Herrmann J.	2383 Hockwin O.
3056 Heckingbottom R.	806 Herrmann O.	1750 Hodes L.
3531 Hedegard B.	2768 Hertz C.H.	2226 Hodges D.
2299 Hederer A.	3226 Herz H.	1215 Hodges J.A.
3214 Heeley K.	2405 Herziger G.	64 Hodgson R.T.
391 Heethaar R.M.	602 Herzog H.	2056 Hodgson W.R.
3543 Hehrlein F.W.	3443 Herzog K.	3397 Hoefler E.E.
1705 Heidelbaugh N.D.	262 Hess H.	3372 Hoeks A.
2498 Heigwer G.	2701 Hesse A.	2035 Hoekstra A.
1917 Heindel L.E.	2141 Hethcote H.W.	2023 Hoekstra I.S.
881 Heinrich L.	2717 Hethcote H.W.	2845 Hoeltzenbein J.
3667 Heinrich K.W.	281 Heuck F.	2015 Hoetzel H.
3460 Heinrichs W.	2918 Heuck F.	2357 Hoetzel H.
589 Heintzen P.	945 Heurtley J.C.	1639 Hoff H.E.
280 Heinze H.G.	3154 Heyman J.S.	1731 Hoffer E.P.
1738 Heise M.	1921 Heynen H.P.	2110 Hoffer E.P.
1763 Heise M.	2901 Heyser R.C.	3185 Hoffler G.W.
2541 Heise M.	2404 Heywood J.D.	2573 Hoffman A.S.
2806 Helfant R.H.	2537 Hibbs C.W.	3027 Hoffman C.M.
204 Hellekrant G.	1058 Hickling R.	2699 Hoffmann H.
195 Hellmann G.	2701 Hienzsch E.	2900 Hoffmann H.
2723 Helms H.D.	3305 Hiernaux J.	1703 Hofman D.A.
1174 Helstrom C.W.	2092 Higashi T.	2314 Hofmann D.J.
647 Helwin H.	57 Higgins P.	1922 Hofmann F.
3333 Hemami H.	1524 Higgins R.J.	2517 Hofmann H.
1142 Hemelaar A.	975 Hilal S.K.	1781 Hofmeister J.H.M.
2035 Hemelaar A.	1201 Hilborn D.A.	3516 Hofmeyr C.
3 Hench L.L.	1010 Hildebrandt B.	785 Hoge F.E.
571 Hench L.L.	3281 Hildebrandt J.	3190 Hogg M.I.J.
105 Henderson B.G.	803 Hill B.	3571 Hogg M.I.J.
3251 Henderson C.	1530 Hill B.	2528 Hogue M.
1672 Henderson D.	3151 Hill C.R.	296 Hohmann E.
2587 Henderson D.	1842 Hill D.	1934 Hohmann H.J.
2636 Henderson D.	902 Hill D.W.	603 Hohne K.H.
2879 Henderson D.	1319 Hill D.W.	1231 Hoidale G.B.
1799 Henderson G.P.	2083 Hill D.W.	2727 Hok B.
2724 Henderson J.M.	2911 Hill D.W.	840 Holbrook J.A.
2043 Henderson L.W.	25 Hill J.J.	790 Holean J.M.

1939 Hollander B.R.	191 Hucke E.E.	3285 Hynecek J.
1595 Hollandsworth C.	2472 Hudetz W.J.	2193 Hyver C.
2410 Holldack K.	288 Hudson A.C.	1181 Hyzer W.G.
688 Hollien H.	2928 Hudson R.E.	3105 Hyzer W.G.
1100 Hollien H.	557 Hueber F.	
1582 Holloway D.F.	2893 Huerta R.H.	1109 Iberall A.S.
2106 Holly D.	1542 Huey D.C.	2230 Ibrahim O.E.
1352 Holm C.	2888 Huf E.G.	3428 Ichihashi M.
2902 Holm H.H.	2889 Huf E.G.	2125 Ichijo B.
2034 Holmer N.G.	2890 Huf E.G.	236 Ichikawa A.
1618 Holmes J.N.	2316 Huffman D.R.	1305 Ide H.
3486 Holmes L.P.	197 Hughes H.C. Jr	3005 Ideker R.E.
25 Holt A.G.J.	3555 Hughes Jr H.C.	66 Idicula J.
1749 Holt J.G.	3211 Hughes K.R.	1718 Igarashi H.
1434 Homsher E.	1525 Hughes M.G.	3346 Ignatyev D.A.
292 Hon E.H.	1121 Hughes T.J.R.	1552 Iinuma K.
1217 Honda T.	1135 Huguenin J.	550 Ikeda T.
2449 Honerloh H.J.	2465 Huis In T Veld F.	2319 Ikeda Y.
1841 Honjo S.	3498 Huisjen M.	2491 Ikels K.G.
1097 Honrubia V.	1686 Huizinga M.	3625 Ikels K.G.
2420 Honzikova N.	43 Hulbert S.F.	1136 Ilani A.
1635 Hood O.C.	570 Hulbert S.F.	1137 Ilani A.
2066 Hook O.	639 Hulbert S.F.	377 Ilin V.V.
1438 Hooley C.J.	1330 Hulbert S.F.	2575 Ilijn V.N.
574 Hopkins J.E.	1274 Hull C.J.	2085 Illhardt R.
2851 Hopman H.	2303 Hullemann K.D.	690 Ilmurzynska K.
3523 Hor D.	2690 Hullemann K.D.	1815 Imachi K.
1910 Horie M.	1479 Hulley L.N.	429 Imboldi E.
102 Horna O.A.	1949 Hulser D.F.	1355 Imhof G.
1950 Hornig D.	1387 Hulting J.	485 Inaba H.
2979 Horowitz J.M.	840 Hummel R.E.	612 Inatomi M.
3510 Horrocks D.L.	3211 Humpherys D.R.	2256 Ince R.H.
2522 Horrocks J.C.	165 Humpherys K.C.	2782 Incropera F.P.
3660 Horrocks J.C.	3425 Humphries J.	3081 Incropera F.P.
2346 Horstman H.M.	3276 Hung G.	3470 Incropera F.P.
2354 Horstman H.M.	1954 Hungerford III E.V.	1122 Ingard U.
983 Horton C.L.	2316 Hunt A.J.	1262 Ingram M.
3685 Horvath R.S.	521 Hunt Jr. E.B.	1654 Inkley S.R.
2568 Horwitz B.A.	275 Hunt M.A.	3639 Inokuchi K.
2979 Horwitz B.A.	3162 Hunter G.	1179 Inokuchi S.
2223 Horwitz C.M.	2412 Hunter S.W.	2371 Inoue H.
1685 Horwitz J.A.	1303 Hunya P.	1241 Inoue K.
2568 Horwitz L.P.	2528 Hunya P.	1241 Inoue M.
1717 Hoshi K.	2398 Hunziker E.	3362 Inoue M.
601 Hoshino F.	1400 Hupfauer W.	892 Intaglietta M.
905 Houben W.P.	1676 Hurkmans G.A.C.M.	925 Inuma K.
1720 Houdek P.V.	1928 Hurrienne E.	2332 Ioffe V.A.
2051 House W.F.	2050 Hursch C.J.	3541 Ipser J.
518 Houser E.A.	1281 Hursen T.F.	2252 Iriyama K.
2894 Houser O.W.	3098 Hurst G.S.	2828 Irnich W.
3265 Houser O.W.	2907 Hursthouse M.W.	3193 Irons L.I.
1986 Houtermans H.	1634 Hurt W.D.	2627 Irving R.E.
2013 Hovermann W.	2427 Hurt W.D.	3014 Irwin D.A.
2516 Howein W.	3179 Hurt W.D.	3516 Isebeck K.
2888 Howell J.R.	283 Husak V.	2144 Isenberg J.
2889 Howell J.R.	864 Hussey M.	2279 Isermann R.
2890 Howell J.R.	1641 Hussey M.	2548 Ishibashi T.
3227 Hristic D.	3155 Huston E.L.	2531 Ishida H.
2296 Hrubesh L.W.	1615 Huston L.J.	2370 Ishikawa H.
376 Hsiao C.C.	584 Hutchinson F.	2379 Ishikawa H.
1178 Hsiao S.S.H.	1982 Hutchinson J.M.R.	1690 Ishikawa S.
1439 Hsu F.T.	164 Hutchison V.H.	2838 Ishizaka K.
79 Hsuan H.C.S.	1684 Hutley M.C.	2425 Ising H.
768 Hu A.S.	2969 Hutton W.C.	3360 Ising H.
502 Huang R.	1131 Huttunen M.O.	3458 Isobe T.
2650 Huang S.C.	3506 Huus T.	2353 Israel H.I.
683 Huang W.N.	1439 Hwang C.L.	3245 Israeli M.
1705 Huber C.S.	45 Hwang N.H.C.	226 Itahashi S.
1576 Huber M.C.E.	321 Hwang S.T.	908 Ito A.
494 Hubner G.	3498 Hyde J.S.	885 Ito H.
1571 Huck F.O.	2369 Hyman L.G.	2497 Ito K.

2496 Itoh K.	2057 Jernigan M.E.	1435 Juchems R.
3577 Ivanoff S.	3603 Jernigan M.E.	2249 Judge F.J.
126 Ivanov A.P.	1405 Jesser W.A.	3338 Julian F.J.
2297 Ivanov V.A.	2611 Jesteadt W.	1342 Junge H.D.
510 Ivanov V.N.	1355 Jester H.G.	3304 Juricic D.
1334 Ivanova L.N.	218 Jezek V.	40 Jurist J.M.
232 Iversen J.A.	1778 Jhon M.S.	42 Jurist J.M.
221 Ives J.R.	3479 Jiggins A.H.	336 Justice K.E.
2121 Ivins J.C.	3522 Joffe I.	2509 Jutier P.
370 Izatt J.R.	247 Joffe L.	3256 Jutier P.
	1165 Joglekar A.V.	
694 Jack C.E.	562 Johansen O.	3081 Kach E.A.
1059 Jackson D.S.	1389 Johansen S.	488 Kadaner A.P.
2282 Jackson J.	3301 Johansson L.	3426 Kadefors R.
2556 Jackson J.L.	2805 Johansson R.	234 Kadoya S.
1254 Jackson P.D.	3504 John A.	1960 Kafalas P.
2945 Jackson R.W.	744 Johns H.E.	2959 Kailath T.
329 Jacob J.H.	2924 Johns H.E.	1348 Kaiser G.C.
2105 Jacobitz K.	2295 Johnsen H.M.	476 Kajfosz J.
3618 Jacobs C.H.	899 Johnson A.L.	1662 Kajima T.
544 Jacobs H.K.	1216 Johnson B.C.	3002 Kajiya F.
1724 Jacobs R.	3280 Johnson B.N.	3322 Kak S.
562 Jacobsen S.	3471 Johnson C.C.	634 Kale A.
2281 Jacobson B.	87 Johnson D.	3438 Kalibjian R.
1067 Jacobson D.H.	334 Johnson D.L.	1947 Kalis H.
3040 Jacobson D.M.	78 Johnson E.A.	2679 Kalis H.
2903 Jacobson G.	2908 Johnson F.	3266 Kalisky A.
2492 Jacquet M.	8 Johnson Jr L.B.	99 Kaliyugavaradan S.
611 Jacquez J.A.	15 Johnson Jr L.B.	299 Kallweit E.
3380 Jacquez J.A.	999 Johnson Jr L.B.	323 Kaloyannides T.M.
2174 Jaeckel S.M.	2442 Johnson L.A.	414 Kalvius G.M.
1390 Jaffe C.C.	2 Johnson L.B.	2832 Kamakura S.
1283 Jaffrin M.Y.	2554 Johnson L.B.	2684 Kamel S.A.
2652 Jaffrin M.Y.	2633 Johnson R.A.	1779 Kamerbeek E.M.H.
725 Jager U.	1965 Johnson S.	550 Kamikawa K.
1333 Jahns E.	2162 Johnston R.C.	2333 Kaminow I.P.
3672 Jahns R.	2608 Johnston R.C.	1288 Kamiya A.
3243 Jain S.C.	1009 Johnston R.G.	3590 Kamiya J.
730 Jain V.K.	2593 Johnstone B.M.	2742 Kammin M.R.
3242 Jain V.K.	356 Johnstone R.M.	1732 Kamp M.
1056 Jakobsson E.	3125 Joines W.T.	2344 Kan S.
3181 Jamieson C.	3205 Joines W.T.	2110 Kanarek D.
1729 Jamin K.	1546 Joly M.	1883 Kanaya K.
2730 Janczarski I.	494 Jones A.R.	1177 Kanazawa Y.
540 Janicki J.S.	3061 Jones D.G.	1652 Kane G.R.
2551 Janko B.	976 Jones G.R.	316 Kaneko T.
2369 Jankowski D.	308 Jones J.E.L.	2107 Kaneko T.
2883 Janovsky F.	609 Jones J.E.L.	653 Kannan D.
1724 Janssens A.	308 Jones J.H.	3636 Kanta C.
1909 Jantsch O.	609 Jones J.H.	2431 Kantrowitz A.
44 Janz R.F.	2292 Jones M.E.	3065 Kanzig H.
2552 Jaque F.	3007 Jones N.B.	3066 Kanzig H.
3463 Jarhult J.	3110 Jones O.C.	1346 Kapatos G.
3104 Jarvis J.R.	2452 Jones R.	3637 Kapitanov N.N.
1721 Jasinska M.	3086 Jones R.	3335 Kapitany S.
3255 Jatlow P.	3092 Jones R.V.	3040 Kaplan B.Z.
1816 Jay A.W.L.	140 Jones R.W.	2396 Kaplan J.H.
62 Jayant N.S.	2678 Jones T.B.	436 Karapetyan B.O.
2271 Jayashri T.	727 Jongsma H.W.	1544 Karasek F.W.
2565 Jayne L.W.	1615 Jordan J.P.	1625 Karasek F.W.
2013 Jecht U.	380 Jorgensen J.E.	2294 Karasek F.W.
3197 Jeck D.	2041 Jorgensen L.	3158 Karasek F.W.
133 Jeffress L.A.	3239 Jorulf H.	3514 Karatoteva T.
2486 Jelenko III C.	1736 Joseph K.	790 Karger A.M.
2074 Jellins J.	3163 Joseph N.T.	492 Karizhenskiy Y.Y.
2499 Jellins J.	3151 Joshi G.P.	2992 Karlovich R.S.
2628 Jen P.H.	3676 Jost R.G.	400 Karlsson L.
2632 Jen P.H.	3626 Jouffray L.	2363 Karlsson L.
2904 Jenkin C.G.	3489 Jovin T.M.	3410 Karning H.
166 Jenkin J.G.	3644 Jovine R.	3270 Karring T.
3396 Jeremiasen R.	1473 Joyce D.N.	568 Karski T.

714 Karvaly B.	45 Kennedy J.H.	3593 Kirol M.K.
1130 Karvaly B.	200 Kennedy J.H.	635 Kirton J.
1513 Kashio E.	354 Kenner G.H.	2937 Kirwan W.O.
1713 Kashio E.	3513 Kennett T.J.	3175 Kiryukhin V.I.
2323 Kashiwagi H.	1847 Kenworthy G.	438 Kiselev B.A.
2792 Kasuya H.	2045 Kepner L.A.	706 Kislyakov Y.Y.
1078 Katchalsky A.	548 Kern E.	1103 Kislyakov Y.Y.
1184 Katchinoski R.	92 Kerns Jr D.V.	1453 Kislyakov Y.Y.
498 Kato S.	1962 Kersten R.T.	3004 Kislyakov Y.Y.
416 Katsman V.I.	2320 Kersten R.T.	3277 Kiss G.R.
1513 Katsurada M.	3127 Kertesz J.	918 Kissinger P.T.
1713 Katsurada M.	1635 Keshishian J.M.	2454 Kita H.
907 Kattwinkel J.	2865 Kettlety A.	2658 Kitagawa T.
1560 Katz R.	385 Keunicke P.	3290 Kitagawa T.
1571 Katzberg S.J.	2934 Kevanishvili Z.S.	2319 Kitano I.
3112 Katzir A.	1273 Kevorkias M.	2108 Kitney R.I.
2185 Katzir Katchalsky A.	1829 Kewlishvili G.E.	2399 Kitney R.I.
3320 Kauffman S.	3244 Keyes W.I.	878 Kivisaari J.
17 Kauffman S.A.	3192 Khan M.A.	2651 Kivity Y.
516 Kaufman A.D.	1332 Khandelwal G.S.	402 Klabukov A.G.
2774 Kaufmann J.S.	1863 Khanijo M.K.	403 Klabukov A.G.
2288 Kaufmann K.J.	1293 Khanin M.A.	188 Klatt D.H.
341 Kavanagh R.J.	2781 Kharasch J.A.	1257 Klatt D.H.
3063 Kavanagh R.J.	1614 Khaspekov L.G.	2990 Klatt D.H.
2192 Kawabata N.	3175 Khayutin V.M.	43 Klawitter J.J.
959 Kawai M.	2934 Khechinashvili S.N.	570 Klawitter J.J.
151 Kawakami H.	2190 Khodorov B.I.	2109 Klee G.
908 Kawakami K.	3501 Khoi L.D.	1418 Kleimenov A.N.
1883 Kawakatsu H.	1469 Kholodenko B.N.	2373 Klein A.G.
121 Kawamura K.	1127 Kholopov A.V.	3504 Klein H.
2219 Kawasaki T.	2033 Kholopov A.V.	1984 Klein J.
2359 Kawase Y.	796 Khomyakova F.T.	2272 Klein S.
2559 Kawashima H.	3100 Khoshnevisan M.	280 Klein U.
207 Kay J.H.	1948 Khuri R.N.	283 Kleinbauer K.
1255 Kazarian K.V.	815 Kiang A.K.C.	2825 Kleine H.O.
2110 Kazemi H.	42 Kianian K.	2827 Kleine H.O.
2851 Kazner E.	226 Kido K.	1124 Kleiner B.
1789 Kear F.W.	2792 Kido K.	2111 Kleinmuntz B.
2721 Keck T.S.	2397 Kiefer J.	2277 Kless H.
1324 Keeble R.	1261 Kiefhaber P.	2493 Klevenhagen S.C.
2564 Keener M.S.	2047 Kiefhaber P.	2238 Kliegis U.
2833 Keep P.J.	3397 Kieslich B.	3559 Kline J.
2246 Kegel A.	1829 Kiknadze W.D.	384 Klingberg F.
2721 Kehl T.H.	2334 Kikuchi T.T.	993 Klinglenmaier C.H.
2825 Keilbach H.	2491 Kilian H.J.	2560 Klingler R.J.
2826 Keilbach H.	3625 Kilian H.J.	2470 Klockhoff I.
2827 Keilbach H.	2876 Killion M.C.	2870 Klockhoff I.
3549 Keilbach H.	3656 Killus J.	1676 Klopogov M.J.G.M.
934 Keim K.L.	3613 Kilp H.	1205 Klose H.J.
1771 Keiner F.	381 Kim B.M.	1287 Kloster F.E.
976 Kellam R.O.	2584 Kim D.O.	3602 Kluger H.A.
1323 Kellenyi L.	1574 Kim H.	3123 Klyukvina V.P.
3005 Keller F.W.	2843 Kim S.W.	1083 Knapp E.
2655 Keller J.B.	2958 Kim Y.J.	2030 Knapp E.
2570 Kellner A.M.	2645 Kimball W.R.	140 Knapp G.S.
2000 Kellermann K.I.	2715 Kimmel K.R.	2093 Knauff K.G.
405 Kellermann K.J.	312 Kimura E.	2384 Knauth K.
996 Kellner E.	3107 Kimura Y.	1374 Kneppreth N.P.
3450 Kelly S.	131 Kindler E.	3449 Knight G.R.
1510 Kelly T.J.	149 Kindlmann P.J.	1361 Knill Jones R.P.
1584 Kelly T.M.	2123 King F.T.	2384 Knoch H.G.
2603 Kelly W.J.	22 King G.I.	2966 Knoell A.C.
2605 Kelly W.J.	3214 King H.	2922 Knopp R.
3146 Kelsey C.A.	1143 King J.G.	4 Knott K.F.
1348 Keltner R.M.	573 King R.	1484 Knott K.F.
1130 Kemeny G.	1060 Kinley C.E.	1461 Knox C.K.
3506 Kemp K.	1194 Kinniment D.J.	1845 Knox K.A.T.
369 Kemperman J.H.B.	908 Kira S.	558 Knull B.
3395 Kendall B.R.F.	1155 Kiralyfalvi L.	3123 Knyazheva T.K.
620 Kendall R.	2531 Kiritani S.	3285 Ko W.H.
1490 Kennedy E.J.	2170 Kirman J.H.	3426 Ko W.H.

3556 Ko W.H.	1449 Korn A.	411 Krigman A.
151 Ko Z.	1575 Korn D.M.	1940 Krigman A.
536 Kobayashi A.S.	3202 Korn V.	2660 Krinskii V.I.
124 Kobayashi H.	129 Kornilov A.P.	75 Krinsky V.I.
431 Kobayashi H.	2802 Kornitzer M.	1458 Krinsky V.I.
1186 Kobbe R.	2656 Kornreich F.	1830 Krinsky V.I.
3299 Kobbe R.	780 Kornreich P.	2046 Krinsky V.I.
3430 Kobozev Y.K.	409 Korolev Y.V.	2459 Kripke B.R.
2305 Koch B.H.	2484 Korostoff E.	1749 Krippner K.
3298 Koch G.G.	2741 Korpinen E.L.	1147 Krishnaiyer R.
591 Koch R.	894 Korsukewitz J.	2960 Krishnamurthy K.H.
1219 Kochelap V.A.	1971 Koryu Ishii T.	1527 Krishnan A.
1227 Kocher L.F.	775 Korzhov V.I.	2902 Kristensen J.K.
1764 Kocsis W.A.	850 Korzhov V.I.	3245 Kristianpoller N.
1238 Kodaras M.J.	2081 Korzhov V.I.	775 Krivutsa Y.N.
662 Koenderink J.J.	1554 Kosarov D.	2212 Krogmann U.
3544 Koenig E.	3453 Koshland Jr D.E.	364 Krol V.M.
1936 Koeppe W.	476 Kosina Z.	2464 Krol V.M.
2725 Koeppe W.	3645 Koskinen P.	315 Krongauz A.N.
2191 Koetsawang A.	2074 Kossoff G.	3581 Kronick P.L.
2191 Koetsawang S.	2499 Kossoff G.	625 Kronradova K.
242 Kogan A.B.	1293 Kossov A.S.	2550 Kropp J.
1310 Kogan A.B.	2751 Kossova N.F.	728 Krpic D.K.
2194 Kogan A.B.	1851 Koster M.P.	2062 Krueger J.L.
3106 Kohen C.	577 Koster W.G.	2762 Kruger E.H.
3106 Kohen E.	718 Kostyuk P.G.	3410 Kruger H.
1341 Kohler C.	276 Kotasek A.	2523 Kruger R.P.
1905 Kohler R.	3518 Kothari L.S.	2809 Krugmire Jr R.B.
2948 Kohno I.	3541 Kotikova K.	2188 Krupa J.
178 Kohut J.	30 Kott M.	718 Kryshtal O.A.
2378 Koicki A.	3049 Kottler M.S.	623 Kryspin J.
2378 Koicki S.	1908 Koudela Jr. J.	1311 Kryter K.D.
1975 Koike R.	2245 Koudstaal J.J.	1566 Kryzhanovskiy B.P.
2698 Koike Y.	3682 Koukkou M.	486 Kryzhanovskiy V.I.
2319 Koizumi K.	3099 Kouskoulas V.	834 Kubarev S.I.
75 Kokos Y.M.	1781 Koutstaal J.P.	913 Kubin M.
1458 Kokoz Y.M.	212 Kowalski J.	3458 Kubota S.
1830 Kokoz Y.M.	3186 Kowalski J.	989 Kuehn L.A.
2660 Kokoz Y.M.	780 Kowel S.T.	582 Kuhn H.
2338 Kolak A.	487 Kozhevnikov Y.G.	421 Kuijk K.E.
3606 Koles Z.J.	212 Koziorowski A.	123 Kujoory M.A.
3607 Koles Z.J.	470 Kozlov M.G.	1219 Kukibnyi Y.A.
2815 Kolff W.J.	1492 Kraft D.W.	69 Kukushkin N.I.
1010 Koller S.	122 Kraft W.	2811 Kukushkin N.I.
1285 Kolobow T.	2715 Kraiss K.F.	2007 Kulikowski R.
1298 Kolobow T.	1144 Kralik O.	1796 Kullback S.
3266 Kolodny G.M.	80 Krane K.S.	1878 Kuller H.
2339 Kolokolov A.A.	633 Krane W.R.	485 Kumaki K.
1465 Kolta P.	174 Kranz P.R.	2729 Kumar Guha S.
667 Komenda S.	3208 Krashen S.	3429 Kumar R.
2198 Komenda S.	2225 Kraus K.	3138 Kump P.
3364 Komenda S.	3456 Kraus K.	2079 Kundel H.L.
3365 Komenda S.	1771 Krause G.	2545 Kuner E.H.
3366 Komenda S.	1398 Krauss H.L.	959 Kuntz I.D.
772 Komoda T.	2826 Krautzberger W.	322 Kunze C.
1507 Komoda T.	3549 Krautzberger W.	143 Kunzel R.
690 Kompiler J.	1643 Krayenbuhl H.P.	1858 Kunzel R.
833 Konaeva G.Y.	2742 Kreid D.K.	1943 Kunzel R.
1300 Kondo A.	462 Kreider J.F.	2644 Kuonen E.
733 Kondoh T.	2047 Kreitmair A.	3204 Kuperman A.M.
3129 Koningsberger D.C.	3050 Krekow G.	490 Kupriyanov Y.S.
835 Kononov V.I.	515 Kremkau F.W.	775 Kurinko V.A.
888 Konopasek F.	1230 Kremkau F.W.	850 Kurinko V.A.
915 Kooijman J.M.	2774 Kremkau F.W.	401 Kurnel G.I.
1622 Kooiman C.J.	2268 Krenke G.	3639 Kusaba A.
2734 Koorajian S.	3029 Kresse H.	372 Kushpil V.I.
320 Kopecek J.	3165 Kresse H.	2281 Kusoffsky L.
3339 Korbacher G.K.	3632 Krestel E.	1867 Kusters N.L.
587 Korbek K.	920 Krieglstein J.	1360 Kuttig H.
3556 Korbek G.K.	776 Krieser J.	795 Kuttner P.
1331 Korchagina M.V.	3235 Krieser J.	3655 Kuzin V.F.

495 Kuznetsov A.Y.	1271 Lary A.	2342 Lehmann J.F.
2310 Kuznetsov A.Y.	1384 Lasdon G.S.	3459 Leidheiser Jr H.
2322 Kuznetsov A.Y.	3252 Lasdon L.S.	1226 Leighton W.H.
402 Kuznetsova N.A.	1187 Laszlo C.A.	1790 Leiner G.
1072 Kvalseth T.O.	1601 Laszlo C.A.	1533 Leis C.T.
625 Kvalca V.	2957 Lat J.	520 Leisey F.A.
503 Kycia T.F.	2617 Latimer J.S.	1178 Leith E.N.
615 Kyner J.L.	2667 Latorre R.	3312 Leitmann G.
	208 Lau F.Y.K.	3144 Leleux P.
2165 Laaper W.J.M.	1749 Laughlin J.S.	3264 Lellouch J.
1286 Labarthe D.R.	3238 Laughlin J.S.	2700 Leman A.
1877 Laber H.	2414 Laun H.M.	1947 Lemmrich J.
3491 Labrunie G.	2426 Laun H.M.	164 Lengyel G.
2747 Labs D.	3546 Laun H.M.	1245 Lenoble J.
1258 Ladefoged P.	3564 Laun H.M.	2093 Lens G.A.
680 Ladik J.	117 Launer H.G.	3651 Lensch S.
3156 Lagerholm S.	1294 Laurent D.	1884 Lent A.
3604 Lagerholm S.	2976 Lautenschlager E.P.	2064 Lentz W.E.
829 Lagutin V.I.	1294 Lautier A.	2766 Lentz W.E.
2182 Lahav J.	3280 Lavelle F.J.	2109 Leonard A.
2376 Laichter Y.	317 Lavelle J.F.	639 Leonard R.B.
2940 Laidler K.J.	857 Lavender J.P.	972 Leppo M.
949 Lakowski R.	2177 Laver M.B.	30 Lerche D.
1043 Lalakin A.V.	511 Lavi N.	867 Lerner R.M.
2709 Lally J.S.	2351 Lawler R.G.	2488 Leroux J.
341 Lamba S.S.	2 Lawless K.R.	144 Lesage P.
738 Lambert D.H.	8 Lawless K.R.	2859 Lescouffair G.
66 Lambertsen C.J.	2588 Lawrence M.	1599 Leshowitz B.
2533 Lambrecht L.G.	2553 Lawrence W.H.	2615 Leshowitz B.
1584 Lambrecht R.M.	1747 Lawrie T.D.V.	1627 Lesigne C.
1595 Lamoreaux R.	201 Lawson D.D.	1868 Leskovar A.
614 Lampard D.G.	1853 Lawton R.A.	1322 Lessel M.R.
1758 Lampard D.G.	3528 Lazarus J.H.	360 Lesser M.B.
528 Lampert R.H.	1042 Le Anh Son	1500 Lester R.G.
1235 Lancee C.T.	938 Le Borgne R.	3015 Leung K.V.
1809 Landahl H.D.	2901 Le Croisette D.H.	3370 Leung K.V.
2560 Landecker T.L.	3648 LeBeux P.J.	3663 Leung K.V.
808 Landis J.R.	744 LeBlanc J.C.	1535 Leung V.P.
2325 Landry M.J.	839 LeBlanc J.C.	1906 Levan D.
2327 Landry M.J.	225 Lea W.A.	364 Levashov O.V.
2818 Lanford H.W.	2522 Leaper D.J.	2464 Levashov O.V.
2935 Lanford H.W.	1522 Leavitt G.A.	3203 Levi G.
2485 Lang A.H.	927 Lebedev V.P.	2481 Levi L.
2357 Lang B.	91 Leblanc C.L.	2842 Levi S.
1824 Lang K.	166 Leckey R.C.	962 Levik Y.S.
1376 Lang N.	1782 Lecoy G.	248 Levin B.W.
1753 Lang N.	2753 Lecuyer D.W.	315 Levin F.I.
1526 Langenthal I.M.	1811 Lee C.O.	532 Levin K.
2626 Langford T.L.	1065 Lee C.P.	2437 Levin K.
2336 Langlet A.	550 Lee Choong Tye	2308 Levin Y.Z.
2375 Langley R.A.	821 Lee D.R.	1264 Levine G.
1141 Langohr H.D.	2973 Lee G.C.	3302 Levine S.H.
1214 Langouet L.	1404 Lee H.S.	1330 Levine S.N.
1656 Lanham C.E.	295 Lee R.D.	3482 Levitina E.I.
2971 Lanir Y.	1007 Lee S.J.	258 Levitt H.
2514 Lantner K.W.	810 Lee T.C.	3598 Levitt R.A.
2102 Lanzi L.H.	1193 Lee T.C.	73 Lew H.S.
1585 Lanzl L.H.	3232 Lee T.D.	3502 Lewin A.J.
305 Lapage S.P.	2915 Leeper D.G.	2850 Lewin M.
604 Lapage S.P.	174 Lees S.	517 Lewiner J.
605 Lapage S.P.	1620 Lees S.	1531 Lewis C.P.
2913 Lapinski H.	3352 Lefort M.	1658 Lewis D.W.
572 Lapitsky M.	2116 Legoffic J.P.	2112 Lewis G.W.
2184 Lapointe A.C.	1085 Legoux J.P.	1734 Lewis J.F.
3352 Larcen A.	314 Legrain M.	3552 Lewis K.B.
3186 Laros C.D.	1989 Legrand J.	1264 Lewis L.L.
3117 Larsen J.G.	3139 Legrand J.	2276 Lewis M.
3511 Larsen R.S.	517 Legros D.	644 Li S.
871 Larson K.B.	2400 Lehiste I.	2552 Liabres J.
2216 Larson R.E.	3682 Lehmann D.	1307 Liberman R.
3224 Larson W.L.	2520 Lehmann E.H.	1805 Liberman Y.A.

2199 Liberman Y.A.	1487 Lohstroh J.	551 Maasse W.
1809 Licko V.	1586 Loken M.K.	3094 Mabilde C.
3218 Liden G.	1622 Lomas B.	1675 MacClement B.A.E.
158 Lidgard G.	2927 Londeree B.R.	1833 MacGregor R.J.
2353 Lier D.W.	3207 Long D.M.	1836 MacGregor R.J.
166 Liesegang J.	597 Long Jr J.H.	183 MacIntosh I.P.
2214 Liesegang J.	2412 Long V.	1654 MacIntyre W.J.
3001 Lih M.M.	2993 Long W.F.	1867 MacMartin M.P.
3623 Lilius H.G.	944 Longini R.L.	2793 MacNeilage P.F.
202 Lilja B.	2711 Longo M.J.	3037 Macalindin I.
559 Lilly D.J.	79 Lonngren K.E.	880 Maccario J.
560 Lim J.J.	465 Lonsdale E.M.	3450 Macfarlane A.W.
2255 Limann O.	613 Loogen F.	1747 Macfarlane P.W.
2696 Limb J.O.	3372 Lopes Da Silva F.H.	712 Macgregor R.J.
1037 Lin C.C.	3130 Lopez P.	1963 Mack A.R.
1568 Lin C.I.	3066 Lorenz R.	1375 Mackay I.R.
3077 Lin I.J.	3674 Lotter M.G.	1752 Mackay I.R.
2318 Lin J.C.	3552 Love J.W.	3350 Mackay R.S.
1691 Lin W.C.	1239 Love R.H.	3412 Mackay R.S.
3437 Lin W.C.	3453 Lovely P.	3419 Mackay R.S.
2567 Lincoln T.	1970 Low F.J.	3548 Mackay R.S.
1810 Lincoln T.L.	235 Lowe Bell S.S.	466 Mackey M.C.
2066 Lindberg B.	2602 Lowe Bell S.S.	2082 Mackiewicz H.
3654 Lindberg D.A.B.	902 Lowe H.J.	1345 Mackintosh I.P.
2022 Lindblom B.E.F.	3499 Lowe I.J.	872 Macko D.
3379 Lindemann B.	1158 Lowe P.J.	2240 Maclean T.S.M.
2785 Lindemann H.	2475 Lowe R.F.	2610 Macmillan N.
972 Linden D.	1992 Lowenthal G.C.	327 Macnab I.
2844 Lindholm T.	2285 Loya J.	3453 Macnab R.
2226 Lindquist Lindquist J.	2751 Lozinskaya S.B.	3144 Macq P.C.
1602 Lindqvist J.	2730 Lubaszka E.	1366 Macy Jr J.
1339 Lindsay M.	1892 Lubbe B.	1009 Madden R.P.
632 Lindsay W.	1121 Lubliner J.	177 Madsen H.S.
2034 Lindstrom K.	3652 Lucas D.	3391 Magison E.C.
1016 Ling G.N.	2164 Lucas D.B.	1989 Magnier P.
25 Linggard R.	1952 Ludt H.	1393 Magora A.
2782 Link W.J.	1047 Ludwig D.	734 Mahalanabis A.K.
3470 Link W.J.	3234 Ludwig H.W.	2137 Mahalanabis A.K.
1172 Linz H.	3097 Luebbers D.W.	1113 Mahalingam R.
961 Liou S.Y.	2248 Luedicke E.	1861 Mahapatra S.
1203 Lipa J.A.	3023 Luft J.H.	2217 Maidanik G.
3295 Lipnik P.	3191 Lughiani R.	3149 Maino G.
2965 Lippert H.	1020 Lui Y.Y.	1027 Maitra S.
1329 Lippert III F.G.	2059 Luizov A.V.	1587 Majborn B.
2985 Lipscomb D.M.	1614 Lukyanova L.D.	1906 Majithia J.C.
1965 Lipsett F.R.	1096 Lummis R.C.	793 Majkowski R.F.
3638 Lipshitz H.	2425 Lunkenheimer P.P.	61 Makhoul J.
1107 Lishchuk V.A.	3360 Lunkenheimer P.P.	226 Makino S.
860 Liskien H.	833 Lunkina A.A.	375 Makous W.
1772 Liss W.A.	3124 Lushchikov I.I.	59 Maksym J.N.
3565 Lissitzky S.	1642 Luttkus G.O.	1112 Malcolm J.E.
2303 List M.	1501 Luxton M.	3536 Malcolm Thomas B.
531 Litt M.	2875 Luz G.	1564 Maleyev Y.N.
3192 Litt M.	2985 Luz G.A.	2553 Malik M.
2853 Little W.A.	2211 Lwin T.	172 Maling Jr G.C.
1537 Liu B.	401 Lykov V.M.	1236 Maling Jr G.C.
2972 Liu Y.K.	2843 Lyman D.J.	2634 Maliniak R.
3622 Liu Y.K.	822 Lynch A.C.	628 Malinowsky H.
1745 Lively W.M.	771 Lynch J.J.	2897 Mallard J.R.
3257 Livesey J.H.	1723 Lynch P.R.	265 Mallon J.
2119 Llewellyn Thomas E.	1032 Lyngborg K.	916 Malowany A.S.
2943 Llewellyn Thomas E.	2773 Lyon R.H.	3124 Mamakina S.V.
423 Lobenstein H.	1981 Lyons J.D.	2755 Mancianti M.
1788 Lobl H.	2642 Lythgoe J.N.	1751 Mancini P.
2031 Lockhart R.A.	3113 Lyubavskiy Y.V.	2107 Mancini P.
1362 Lodwick G.S.	2467 Lyubinskii I.A.	2444 Mandel R.
3270 Loe H.	1129 Lyubinsky I.A.	2833 Manford M.L.M.
2873 Loeb M.	682 Lyudkovskaya R.G.	3393 Manfredi M.
2875 Loeb M.		3370 Mangeron D.
1295 Loewenstein M.	2884 Maas R.	2910 Manley M.T.
1574 Loewenstein M.A.	3542 Maass W.	2095 Mann D.M.A.

732 Mann J.B.	1866 Marthinsson B.	3200 Maynard D.E.
1957 Mann W.B.	3054 Martin C.J.	33 Mazanov A.
1958 Mann W.B.	3584 Martin F.E.	1479 Mazumder N.C.
1982 Mann W.B.	3440 Martin J.E.	1646 Mazurov M.Y.
2460 Mannard A.	3386 Martin N.D.	2772 McCandless S.S.
1481 Manning B.C.	994 Martin R.D.	1135 McCann F.V.
3345 Mannos J.L.	89 Martin R.W.	1525 McCann F.V.
1850 Manoharan L.C.	3018 Martin T.P.	1950 McCann F.V.
2236 Manoharan L.C.	1415 Martinez H.M.	2539 McCann F.V.
3039 Mansfield P.	1255 Martirosov S.M.	318 McCann G.D.
3131 Mansfield P.	443 Martres R.	988 McCarl C.C.
1348 Mansoori S.	2738 Martynov V.M.	3060 McCarthy M.J.
3124 Mansvetov N.G.	788 Maruse S.	3217 McClain S.C.
3190 Mapleson W.W.	3428 Maruse S.	1538 McClellan J.H.
1023 Marakhova I.I.	968 Marx G.F.	3248 McCluggage C.
3328 Marakhovskii V.B.	1351 Marxer J.J.	3438 McConaghy C.F.
24 Marakhovsky V.B.	1378 Marxer J.J.	544 McConnell D.P.
982 Marchal M.	1577 Marzoyev A.I.	2115 McCormack G.
982 Marchal M.T.	1248 Mashour M.	1438 McCrum N.G.
27 Marchi E.	2530 Maslov V.K.	3265 McCullough E.C.
2113 Marciano F.	157 Mason I.M.	3023 McCutchen C.W.
1482 Marco C.	2495 Mason M.	3466 McCutchen C.W.
3487 Marcus R.T.	530 Mason R.G.	507 McDaniel F.D.
1503 Marcuse D.	2365 Massam T.	864 McDicken W.N.
1578 Mardaeva A.I.	2372 Massam T.	1339 McDicken W.N.
991 Marg E.	2409 Massie H.L.	1641 McDicken W.N.
2115 Marg E.	234 Massopust Jr L.C.	1116 McDonald D.A.
3276 Marg E.	2125 Masuda Y.	3658 McDonald J.C.
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2622 Margolis B.L.	2807 Mates R.E.	2908 McDonald T.
2614 Margolis R.H.	2087 Mather B.S.	507 McEllistrem M.T.
1932 Maringer R.E.	1531 Mathew M.I.	1443 McFadden D.
1966 Marino D.	1375 Mathews J.D.	2726 McGarr D.M.
771 Marjoram A.R.	1752 Mathews J.D.	1977 McGeorge J.C.
58 Markel J.D.	178 Mathews M.V.	3333 McGhee R.B.
1540 Markel J.D.	2787 Mathieu C.M.	841 McGraw J.T.
2989 Markel J.D.	2938 Mathys R.	2910 McGuinness J.B.
670 Markin D.S.	1048 Matioli G.	2028 McHale P.A.
97 Markin V.A.	2654 Matousek M.	3435 McHardy W.J.
77 Markin V.S.	433 Matskovskaya Y.Z.	164 McIlvaine P.M.
219 Markin V.S.	967 Matskovskaya Y.Z.	3160 McIlwrick C.R.
387 Markin V.S.	2448 Matsuda M.	22 McIntosh T.J.
671 Markin V.S.	772 Matsuda T.	3525 McKenna J.M.
825 Markin V.S.	1716 Matsuda T.	2122 McKeown J.
1044 Markin V.S.	3417 Matsumoto G.	214 McKerron C.B.
1309 Markin V.S.	2029 Matsumoto H.	166 McLachlan A.D.
1421 Markin V.S.	3458 Matsumura Z.	3294 McLachlan G.J.
1460 Markin V.S.	925 Matsuo T.	879 McLaren E.A.
1467 Markin V.S.	1552 Matsuo T.	1362 McLaren R.W.
2199 Markin V.S.	866 Matsuzawa K.	3010 McLaughlin S.
2200 Markin V.S.	1660 Mattausch H.	1700 McLellan D.L.
2202 Marko H.	2690 Matthes D.	169 McMath T.A.
2445 Marko H.	2905 Matthes D.C.	2863 McNair J.
1857 Markov V.I.	1819 Matthews A.	3164 McNall Jr P.E.
1080 Markowitz D.	774 Matthews J.E.	466 McNeel M.L.
1397 Marlowe F.J.	1976 Matthews J.L.	155 McNeil J.A.
1516 Marlowe S.	2580 Mattiazzi A.	55 McNeill D.
3371 Marmarelis P.Z.	3263 Mauderli W.	3507 McNelles L.A.
162 Marowsky G.	1377 Maugh II T.H.	2123 McPherson J.
169 Marrello V.	2913 Maury M.	49 McQuarrie D.A.
3193 Marriott C.	2030 Mauser R.	1580 McRee D.I.
3194 Marriott C.	1866 Max E.	3677 McReynolds C.R.
2127 Marschik W.	3109 Max E.	689 McRobert H.
2265 Marschik W.	1361 Maxwell J.D.	1762 Mclean K.H.
154 Marshall A.G.	2127 May F.	2068 Meachim G.
3052 Marshall D.C.	2265 May F.	346 Mead J.
465 Marshall Jr W.C.	558 May G.	234 Meder R.
974 Marshall R.B.	3581 May R.C.	3143 Medici G.
9 Marshall R.P.	123 Mayall B.H.	2461 Meehan E.
2331 Marshall T.R.	169 Mayer J.W.	120 Meehan J.P.
456 Marsoner H.J.	1279 Mayhan K.G.	3413 Meehan J.P.

3414 Meehan J.P.	386 Michaelis B.	492 Miroshnikov M.M.
106 Meese J.M.	713 Michaelis B.	2913 Mirouze J.
2540 Meester G.T.	2196 Michaelis B.	1433 Mirsky I.
1357 Megla G.K.	306 Michaelis J.	1437 Mirsky I.
261 Mehaffey III L.	1010 Michaelis J.	3175 Mirzadaeva L.A.
2177 Mehmehl H.	2805 Michaelsson M.	1176 Misell D.L.
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483 Mehta M.L.	3469 Michel C.F.	2209 Misra K.B.
3243 Mehta S.C.	3427 Michel K.	2752 Misra S.K.
3289 Meidinger F.	593 Michelinakis E.	3585 Mitani G.
1810 Meier G.	651 Michell S.	681 Mitchell D.J.
1371 Meier Koll A.	3189 Michels B.	1079 Mitchell D.J.
398 Meijer A.A.	933 Michie P.T.	1634 Mitchell J.C.
1848 Meijer A.A.	1759 Mickelsen O.	3179 Mitchell J.C.
391 Meijler F.L.	1658 Mickley M.C.	3457 Mitchell M.
141 Meincke P.P.M.	111 Middlebrook R.D.	879 Mitchell R.
3359 Meindl J.D.	112 Middlebrook R.D.	3122 Mithapara P.D.
3233 Meisel H.	328 Midgley D.	3363 Mitov D.L.
2025 Meiselman H.J.	1612 Midson A.J.	1542 Mitra S.K.
508 Meister H.	2757 Mieke J.A.	1119 Mittra T.K.
2806 Meister S.G.	1562 Mielenz K.D.	1038 Mix D.F.
836 Melishchuk I.S.	1803 Miernyk W.H.	1883 Miya T.
3463 Mellander S.	3334 Mignone V.	1683 Miyake Y.
2832 Melo C.P.	377 Mikhaylov A.V.	1745 Mize C.E.
1408 Melzer E.W.	488 Mikhaylov O.M.	2029 Mizuno A.
2543 Mendel M.I.	3431 Mikhaylova Y.I.	1367 Mizuno Y.
1814 Mendelevich I.A.	1017 Mikulecky D.C.	923 Mladejovsky M.G.
123 Mendelsohn M.L.	3317 Mikulski A.T.	2477 Mladejovsky M.G.
2156 Mendelson R.A.	2101 Milan J.	3199 Mladejovsky M.G.
749 Mengali U.	233 Milby Jr J.B.	201 Moacanin J.
3323 Menke W.W.	916 Mildenerberger R.R.	1798 Mobley C.D.
1383 Menn S.J.	1594 Miljanic D.	2785 Mocellin R.
1502 Menning J.	1608 Millard J.P.	2128 Mochel J.M.
3211 Menzies J.E.	2411 Miller C.W.	1996 Mocilnik I.
1095 Merchant H.C.	2057 Miller D.	330 Mode C.J.
186 Mermelstein P.	3467 Miller D.B.	3318 Mode C.J.
857 Merrick M.V.	324 Miller I.F.	2887 Modig J.
1584 Merrigan J.A.	936 Miller J.D.	3367 Moffat A.J.M.
2970 Merrill B.R.	3154 Miller J.G.	3601 Moffat A.J.M.
1697 Merrill E.W.	3584 Miller J.H.	606 Moffet C.
1048 Merritt M.	3179 Miller J.K.	550 Mogami H.
291 Merry G.A.	147 Miller K.J.	1749 Mohan R.
2153 Merryman P.M.	3570 Miller L.	46 Mohandas N.
3667 Merx W.	2430 Miller N.C.	3171 Mohandas N.
1757 Mery C.	645 Miller N.D.	1605 Mohl B.
394 Mesa W.	1 Miller R.A.	2820 Mohnhaupt A.
3269 Messer J.V.	1629 Miller R.R.	2822 Mohnhaupt A.
983 Messmer B.J.	2737 Miller S.E.	3274 Mohnhaupt A.
2586 Metz C.E.	1278 Milligan H.L.	2277 Mohnhaupt R.
2097 Metzger H.D.	2057 Millodot M.	2435 Mohnhaupt R.
3144 Meulders J.P.	1913 Mills D.L.	2820 Mohnhaupt R.
1740 Meuwissen J.A.T.P.	1589 Mills Jr A.P.	2822 Mohnhaupt R.
921 Meyer A.U.	2423 Mills M.	3274 Mohnhaupt R.
977 Meyer A.U.	2675 Milnarich Jr P.	586 Mohr H.
722 Meyer A.W.A.	1325 Milner M.	3382 Mohr H.
1664 Meyer C.C.	254 Milner P.	2167 Moisesescu D.G.
964 Meyer C.R.	1996 Milojevic A.	751 Mokari Bolhassan M.E.
756 Meyer F.	438 Milovanov Y.V.	800 Molepske R.J.
2120 Meyer F.J.	856 Milu C.	52 Molino J.
1967 Meyer H.	1224 Mims W.B.	2986 Molino J.A.
1166 Meyer J.	543 Min B.G.	3344 Molino J.A.
3667 Meyer J.	1717 Minami H.	980 Moller T.R.
1664 Meyer O.N.	2664 Minc S.	2345 Mollier J.C.
2976 Meyer P.R.	2304 Mindt W.	3060 Molloy N.A.
459 Meyer R.C.	3605 Minke B.	2584 Molnar C.E.
1727 Meyer Waarden K.	3674 Minnaar P.C.	1434 Mommaerts W.F.H.M.
2267 Mezrich R.S.	1059 Minns R.J.	215 Monkus E.
3064 Mezrich R.S.	1424 Miralles Marrero R.	1133 Montagu J.D.
3459 Micale F.J.	3565 Miranda F.	1579 Montet J.L.
463 Micco A.J.	451 Miranker G.	984 Montgomery E.E.
2227 Michael P.C.	2337 Mironova L.N.	2941 Monzain R.

3519 Moon J.R.	879 Muir W.	1817 Nanjappa B.N.
267 Mooney V.	1968 Mukhamedyarov R.D.	1713 Nanjo Y.
1651 Moore A.G.	2321 Mukhamedyarov R.D.	1807 Nanjundiah V.
1098 Moore B.C.J.	3230 Mukherjee P.	672 Naparstek A.
1688 Moore B.C.J.	3543 Mulch J.	3557 Narasimha Rao C.
2171 Moore B.C.J.	3490 Muldower L.	2349 Narath A.
3348 Moore D.J.H.	3129 Mulder G.J.	1327 Nashold Jr B.S.
1709 Moore E.B.	670 Muler A.L.	1023 Nasledov G.A.
1528 Moore II D.H.	671 Muler A.L.	2677 Nassenstein F.
1411 Moore J.B.	1421 Muler A.L.	1800 Nastansky L.
300 Moore R.	2564 Mulholland R.J.	2195 Nastuk W.L.
3133 Moores B.M.	409 Mulin Y.I.	1261 Nath G.
3678 Moores M.	660 Mullaney P.F.	2047 Nath G.
1585 Moos W.S.	1126 Muller F.J.	665 Nathan A.
2895 Moos W.S.	280 Muller Fassbender H.	893 Nathanson H.C.
2419 Morabito A.	1083 Muller G.	3551 Nation A.W.C.
1563 Morais C.	1702 Muller K.	1559 Natowitz J.B.
34 Moran R.G.	1893 Muller K.H.	76 Naumov A.P.
348 Morawski J.M.	533 Muller L.	6 Naylor R.
3168 Morch J.E.	2091 Muller S.	2554 Neary M.J.
2860 Morelli M.	2856 Mulroy M.J.	1558 Neary M.P.
633 Morf M.E.	3544 Mulz D.	163 Nee S.F.
691 Morgan D.E.	2266 Munchrath R.	1850 Neelakantan S.
1082 Morgan D.E.	3057 Munden A.B.	1527 Neelakantan V.N.
404 Morgan R.J.	2552 Munoz E.	227 Neely R.B.
3593 Morgan R.J.	2903 Muntz E.P.	699 Neff W.D.
3686 Morgan R.J.	2642 Muntz W.R.A.	1005 Negro V.C.
129 Morgunov A.S.	725 Munzel H.	2510 Neill D.W.
2371 Morii T.	159 Murashko M.P.	2241 Nelin B.
1272 Morin P.J.	125 Muratov V.R.	2226 Nelson B.
121 Morinaga N.	151 Murayama K.	785 Nelson B.E.
146 Morinet Lambert J.	496 Murcraay D.G.	1642 Nelson W.P.
1179 Morita Y.	496 Murcraay F.H.	438 Nemchuk I.K.
3336 Moritz W.E.	2104 Murison J.M.	1805 Nenashev V.A.
326 Morley A.R.	176 Murphy P.V.	1743 Nentwig C.
1160 Moroz W.J.	3538 Murphy R.L.H.	947 Neppert J.
2456 Morozov G.B.	984 Murray D.B.	2648 Nerem R.M.
2163 Morris J.M.	499 Murray K.M.	1981 Nesbet R.K.
3091 Morris J.R.W.	1336 Murray K.M.	859 Neubert W.
2663 Morris N.M.	454 Murrill P.W.	994 Neudorfer P.O.
2411 Morris R.L.	2720 Murrill P.W.	2571 Neukomm P.A.
514 Morrow C.T.	448 Musgrave G.	3331 Neukomm P.A.
1617 Mortagy A.L.	844 Musicant B.L.	3415 Neukomm P.A.
1959 Mortensen L.	1581 Musket R.G.	2517 Neumann H.G.
3088 Morton J.B.	2673 Muth H.	2886 Neuschl S.
1520 Morton R.	114 Myers B.R.	372 Neuymina Y.G.
610 Moser K.L.	1281 Myers G.H.	608 Newman A.
737 Moskowitz R.	1637 Myers G.H.	3424 Newman M.
3296 Moss A.A.	1368 Myers R.R.	2489 Newman N.
2721 Moss C.B.		2483 Newsom M.J.
1290 Mosso J.A.	53 Nabelek A.K.	2159 Newsted P.R.
1199 Mostofsky D.I.	53 Nabelek I.V.	620 Ng S.C.
1890 Motoyama H.	257 Nabelek I.V.	3184 Ng Y.L.
771 Mottershead B.E.	3220 Nabelek I.V.	34 Nichol C.A.
3077 Moudgil B.M.	1260 Nadalyak E.A.	1844 Nichols K.G.
3492 Moulin B.	1006 Nadan J.S.	1227 Nichols L.L.
2767 Mountford R.A.	2786 Nadelhaft I.	901 Nichols W.W.
2770 Mountford R.A.	218 Nadvornik P.	1116 Nichols W.W.
2619 Moushegian G.	3107 Nagata I.	2422 Nichols W.W.
634 Moyer D.L.	3526 Nahrwold M.L.	229 Nicholson C.
993 Moyer P.R.	472 Nair P.	1356 Nickerson R.S.
43 Moyle D.D.	2408 Najdanovic B.	158 Nicklin R.
1330 Moyle D.D.	3371 Naka K.I.	2077 Nicol C.
76 Mozhayeva G.N.	2380 Nakamura H.	975 Niebuhr K.E.
2753 Muc A.M.	601 Nakamura M.	1761 Niederjohn R.J.
137 Muchnick S.S.	3494 Nakanishi M.	1315 Nielsen H.B.
3473 Mudhole T.S.	236 Nakano Y.	3505 Niemann E.G.
952 Mueller H.A.	2076 Nakashika M.	18 Niemann H.
2469 Mueller M.M.H.	236 Nakata K.	568 Niemyski W.
2070 Muhic L.A.	246 Nakatani L.H.	2884 Nietert M.
1364 Muic V.	121 Namekawa T.	2244 Nieuwerkerk L.R.

2494 Nievalstein A.M.T.	313 Obrist W.D.	928 Orlovskii G.N.
1721 Niewiadomski T.	1170 Ocheltree S.L.	1561 Ormerod R.C.
3331 Nigg B.	3374 Ochs A.L.	437 Ornis A.N.
2156 Nihei T.	2248 Ochs S.A.	754 Orsi G.
878 Niinikoski J.	1031 Ockey C.H.	2565 Orszag S.A.
831 Niizeki N.	1737 Oeff K.	333 Osadnik L.
442 Nikashin V.A.	1702 Oest O.	887 Osborne B.E.
796 Nikitina O.S.	3640 Offer U.	898 Osborne B.E.
2579 Nikolai R.J.	1053 Offner F.F.	1441 Osman E.
2763 Nikolayev M.I.	2459 Ogden T.E.	2402 Oster G.
956 Nikolayev N.I.	2021 Ogoshi K.	1078 Oster G.F.
470 Nikolayev V.N.	3015 Oguztoreli M.N.	2465 Osterhammel P.
2044 Nikolov N.	3370 Oguztoreli M.N.	646 Ostrander L.E.
922 Nikolsky L.N.	2824 Oh T.	3252 Ostrander L.E.
347 Nilles J.L.	3183 Oh T.	954 Ostrovskaya M.A.
572 Nilles J.L.	2347 Ohlson J.E.	2478 Ostrovskaya M.N.
2580 Nilsson E.	2343 Ohlsson T.	1141 Oswald S.
3588 Nilsson G.	2421 Ohm O.J.	1487 Otala M.
1280 Nilsson K.	2398 Ohnhaus E.E.	1405 Otani H.
681 Ninham B.W.	788 Ohshita A.	2554 Otani H.
1079 Ninham B.W.	2797 Oie S.H.	3446 Ottonello P.
1080 Nisbet R.M.	3249 OBrien B.M.	3224 Outerbridge J.S. -
23 Nitsche H.	596 OBrien B.McC.	2578 Outwater J.O.
184 Nitzberg R.	2801 OBrien Jr W.D.	3113 Ovchinnikov V.M.
849 Nizhin A.M.	641 OBrien W.J.	2718 Ovenden M.W.
1835 Nja A.	1775 OBrien W.J.	1392 Overton T.R.
1558 Noakes J.E.	816 OCallaghan P.W.	3342 Owen R.P.
2065 Noble W.G.	1764 OConnell R.J.	998 Owens R.M.
504 Nomura T.	1024 ODonald P.	1976 Owens R.O.
3180 Noon G.P.	1500 OFoghludha F.	1051 Ozeki K.
527 Nooteboom S.G.	183 OGrady F.	2367 Ozsan F.E.
980 Nordberg U.B.	1345 OGrady F.	
2887 Nordgren L.	72 ORourke R.A.	1060 Paasche P.E.
149 Nordine P.C.	3297 Ojala L.	2251 Pace J.D.
2470 Nordstrand J.	539 Oka S.	626 Packer J.E.
367 Norman J.E.	2362 Okabe S.	626 Packer J.S.
3351 Normand J.P.	3159 Okada S.	1014 Padgett W.J.
3180 Normann N.A.	3033 Okamoto M.	1535 Padmanabhan L.
1659 North R.	1367 Okamoto N.	3300 Paganelli C.V.
329 Northam D.B.	2359 Okano K.	3582 Pagano F.
2902 Northeved A.	2310 Okatova G.V.	2896 Page B.F.J.
310 Norusis M.J.	2322 Okatova G.V.	1008 Page C.H.
623 Norwich A.M.	983 Okies J.E.	2012 Page T.
3168 Norwich K.H.	3612 Oksala A.	65 Paiva M.
2376 Notea A.	1715 Okubo T.	734 Pal J.K.
1088 Novick A.	2694 Okubo T.	1861 Pal R.N.
2313 Novik D.A.	2887 Olerud S.	1454 Palatt P.J.
2081 Novikov A.V.	1032 Olesen K.H.	1455 Palatt P.J.
2407 Novin D.	48 Olien C.R.	3003 Palatt P.J.
141 Novotny V.	3614 Oliva G.A.	2671 Palmay F.V.
1694 Nowell E.	3541 Oliva I.	911 Palmer A.S.
1252 Noyes D.H.	410 Oliver A.F.J.	3508 Palmer H.E.
1115 Nudelman H.	2705 Oliver C.J.	1762 Palmer J.R.
3468 Nullens W.	3591 Oliver J.	2150 Palmer L.C.
1673 Numoto M.	1709 Oliver Jr G.D.	3614 Palmieri G.
509 Nunes A.C.	1959 Olsen J.	723 Palti Y.
1934 Nurnberg R.	3486 Olsen S.L.	3118 Pandolfini P.
2518 Nussbaum R.S.	185 Olson K.W.	1431 Panjabi M.M.
2519 Nussbaum R.S.	807 Omar A.	401 Panov V.V.
3226 Nusselt L.	2886 Ondrejka J.	1130 Pant H.C.
2389 Nute M.E.	245 Onley J.W.	3074 Pantell R.H.
2588 Nuttall A.L.	1714 Ono K.	1258 Papcun G.
1240 Nyborg W.L.	791 Onsmann I.	3208 Papcun G.
260 Nye P.W.	150 Oodan A.P.	16 Papoulis A.
	315 Opanasyuk A.V.	1105 Pardaens J.
1305 Obata S.	941 Opitz H.J.	583 Pardon F.
312 Obayashi K.	1620 Oppenheim F.G.	510 Parfenov E.N.
2673 Oberhausen E.	3039 Orchard M.J.	433 Parfentyev N.A.
1036 Obidegwu S.N.	3644 Orecchio F.	453 Parhami B.
1965 Oblinsky G.	968 Orkin L.R.	3304 Parikh G.
417 Obreimov I.V.	912 Orley J.	1263 Park D.

2573	Park J.B.	1284	Pederson R.W.	3425	Phoebus E.
38	Parker H.G.	398	Peeterse J.	3055	Piazzesi G.
2466	Parker J.A.	3514	Peeva A.	2393	Piccialli A.
2502	Parker J.F.	1285	Pegram S.E.	3381	Pickard W.F.
113	Parker P.A.	647	Peil J.	2864	Pico Jr G.
960	Parker P.A.	1537	Peled A.	718	Pidoplichko V.I.
1553	Parker T.D.	1272	Pelletier B.	96	Piejus P.
1576	Parkinson W.H.	3334	Pelosi V.	3624	Piergallini J.R.
1417	Parks J.R.	2483	Pelosof H.V.	2413	Pierie W.
2745	Parks R.E.	553	Peltzman P.	2293	Pierre Kahn A.
1538	Parks T.W.	3129	Pelupessy B.	1085	Pierson A.
1819	Parmley W.W.	1580	Pendergrass F.T.	3573	Pietraszkiewicz L.
460	Paros J.M.	2585	Fenner M.J.	2856	Pike C.L.
2260	Parr J.C.	639	Per Lee J.H.	2705	Pike E.R.
2892	Parson I.D.	2301	Peregrin J.	1534	Pike Jr H.E.
1281	Parsonnet V.	1078	Perelson A.S.	3437	Pillay S.K.
1637	Parsonnet V.	1021	Periti P.	2708	Piller H.
2709	Parsons D.F.	1982	Perkins R.W.	327	Pilliar R.M.
3030	Parsons J.D.	1919	Perkins W.J.	3063	Pincock D.G.
3324	Parsons J.R.	519	Perlis H.J.	2577	Pinder D.N.
2273	Parzefall F.	1767	Pernier J.	216	Pine S.N.
68	Pasch T.	1301	Perot Jr P.L.	3492	Pinet D.
571	Paschall H.A.	678	Perren S.M.	2872	Pinheiro M.L.
3330	Pasechnik V.I.	1347	Perrin R.G.	2314	Pinnick R.G.
2542	Pasik P.	57	Perrott D.R.	3377	Pinson L.J.
2542	Pasik T.	3042	Perry D.J.	3496	Pinson P.
2892	Pask B.A.	2228	Perry M.A.	994	Pinter R.B.
161	Pask C.	2356	Perry S.K.	3168	Pinto C.
2172	Pask C.	2366	Pertsev A.N.	1074	Pinto J.G.
3349	Pask C.	377	Perveyev A.F.	1075	Pinto J.G.
943	Passechnik V.I.	1566	Perveyev A.F.	1273	Piogor G.
77	Pastushenko V.F.	3328	Peschanskii V.A.	2231	Piontek P.
219	Pastushenko V.F.	24	Peschansky V.A.	1919	Piper E.A.
1309	Pastushenko V.F.	3130	Pescia J.	3277	Piper J.R.I.
1460	Pastushenko V.F.	992	Peskin C.S.	3144	Pirart C.
115	Pasupathy S.	1501	Peter T.	3126	Piruzyan L.A.
2083	Pate T.D.	2620	Peters R.W.	2393	Piscitelli S.
41	Patel D.J.	3434	Peters T.M.	3528	Pisoni D.B.
1870	Paterson J.D.	2945	Peters W.J.	1701	Pistecky P.V.
3628	Patomaki L.K.	1557	Petersen A.B.	1707	Pistor P.
3259	Patrick E.A.	2654	Petersen I.	1268	Pitcher P.M.
424	Patstone W.	2809	Petersen J.L.	1814	Pitkin M.R.
3032	Patt B.	72	Peterson K.L.	1317	Pitts D.G.
693	Patterson R.D.	3582	Petracco S.	1966	Plantamura V.L.
3029	Patzold J.	1364	Petres J.J.	1594	Plasek R.
39	Paul I.L.	579	Petro W.	2471	Plath P.
272	Paul I.L.	1831	Petrov A.A.	2514	Platt R.C.
1061	Paul I.L.	3637	Petrova N.P.	3553	Platts R.G.S.
2572	Paul M.H.	1902	Pettican B.	187	Plomp R.
216	Paul R.H.	3570	Petty T.L.	1632	Plonsey R.
292	Paul R.H.	67	Petukhov S.V.	2750	Plyut A.A.
3145	Paulin A.	1897	Peysakhson I.V.	986	Pocklington P.R.
2000	Pauliny Toth I.I.K.	3114	Peysakhson I.V.	1616	Poczopko P.
419	Paull C.J.	919	Pfaffelhuber E.	3012	Podvigin N.F.
860	Paulsen A.	937	Pfaffelhuber E.	3204	Podvigin N.F.
715	Pauly H.	805	Pfanstiehl A.	3363	Podvigin N.F.
3058	Pavlyuchuk V.A.	3554	Pfeiffer B.	1593	Poenitz W.P.
268	Pavon G.	2584	Pfeiffer R.R.	659	Poggio T.
549	Payne J.E.	1774	Pfeiffer W.	685	Poggio T.
858	Payne J.T.	582	Pfeiler M.	2002	Pohl H.
1586	Payne J.T.	725	Pfennig G.	1979	Pohl K.D.
3098	Payne M.G.	1402	Pfleiderer H.J.	730	Pohlit W.
2253	Pazzi G.P.	1655	Phalen R.F.	2498	Pohlit W.
2939	Peagler F.	2756	Phelps M.E.	51	Pohlmann L.D.
2070	Pearce W.L.	2005	Phelps S.	2764	Poitou J.
1673	Peardon Donaghy R.M.	20	Philip J.	3376	Pokrovskii A.N.
1485	Pearson E.E.	3078	Philips D.M.	389	Pokrovsky A.N.
1447	Pearson J.E.	3160	Phillips C.S.G.	564	Polak E.H.
2394	Pecht I.	1246	Phillips D.T.	2737	Pole R.V.
2178	Pecorini V.	1071	Phillips G.D.	2441	Polhemus J.A.
2421	Pedersen O.M.	2709	Phillips V.A.	2078	Policarpo A.J.P.L.

1919 Polihroniadis P.	2355 Price L.E.	2275 Rajappan K.P.
2259 Politch J.	2506 Price P.H.	2390 Rajotte R.V.
2703 Politch J.	615 Price S.	119 Rakovich B.D.
159 Polishchikov G.V.	932 Prinz W.	2547 Ralston J.M.
54 Pollack I.	3200 Prior P.F.	3591 Ramade F.
1086 Pollack I.	816 Probert S.D.	2855 Ramakrishna T.
1019 Pollak E.	3124 Prokofyeva T.D.	2160 Ramanujam H.R.
187 Pals L.C.W.	2903 Proudian A.P.	1218 Ramaswamy V.
1898 Polushkin Y.I.	3170 Pruitt K.M.	1658 Ramirez W.F.
3152 Pond J.B.	276 Prutar V.	1653 Ramonatxo M.
834 Ponomarev O.A.	979 Pryor T.A.	3138 Ramsak V.
858 Ponto R.A.	1915 Puerling B.W.	2240 Ramsdale P.A.
3247 Pontoppidan J.	329 Pugh E.R.	2094 Ramsey A.
1113 Poon T.K.	38 Pugh J.W.	1993 Ramthun H.
3633 Pope J.M.	1430 Pugh J.W.	3065 Ranalder U.B.
2578 Pope M.H.	1812 Pugh J.W.	1290 Rand R.W.
3618 Pope M.H.	39 Pugh J.W.	260 Rand T.
2992 Popelka G.R.	1770 Puls P.	344 Rand W.M.
1854 Popov V.N.	1920 Pumpe G.	165 Randtke P.T.
990 Popp R.L.	2504 Pumphrey D.	3356 Ranft U.
3568 Popp R.L.	1600 Punch J.	3108 Ranghiasi C.
1461 Poppele R.E.	2139 Puri P.S.	1981 Rankin C.C.
561 Popper A.N.	730 Purohit S.C.	1720 Rao A.
2695 Porfireva N.N.	2478 Putyatina N.M.	1428 Rao A.P.
3046 Pori J.R.		2126 Rao J.R.
2046 Poroticov V.I.	3186 Quanjer P.H.	1283 Rao S.
1500 Porter F.	2412 Quattlebaum F.W.	1705 Rapp R.M.
235 Porter Jr R.J.	938 Quere M.A.	1413 Rashevsky N.
3007 Porter N.H.	1370 Quinlivan J.T.	1470 Rashevsky N.
3595 Porterfield A.L.	66 Quinn J.A.	2662 Rashevsky N.
302 Porth A.J.	2562 Quinn J.A.	3021 Rashevsky N.
293 Portnoy W.M.		366 Rasigni G.
1282 Portnoy W.M.	2609 Raab D.H.	366 Rasigni M.
2537 Portnoy W.M.	1655 Raabe O.G.	3142 Rasmussen S.E.
1360 Poser H.	1083 Raas E.	2206 Rassow B.
1129 Posin N.V.	2030 Raas E.	2191 Ratananetra Y.
2898 Poston J.W.	261 Rabin A.R.	1159 Ratcliffe C.A.
2733 Potter C.W.	203 Rabiner L.R.	622 Rathod C.
2913 Poudevigne T.	806 Rabiner L.R.	324 Ratner B.D.
1216 Pouliot T.W.	1195 Rabiner L.R.	433 Ratner Y.S.
1403 Poultney S.K.	1538 Rabiner L.R.	967 Ratner Y.S.
752 Poussart D.J.M.	2723 Rabiner L.R.	2320 Rauscher W.
3550 Powell M.R.	228 Rabinowitz A.S.	3297 Rautanen E.T.
3291 Powell T.	2914 Rabinowitz M.	1787 Rauth A.M.
1321 Powers G.L.	2608 Rabinowitz W.M.	3162 Rauth A.M.
2645 Powers Jr S.R.	3489 Rabl C.R.	2596 Ravindran A.
3254 Powsner E.R.	856 Racoveanu N.	3361 Ravindran R.
2467 Pozin N.V.	3011 Radchenko A.N.	1292 Rawitscher R.E.
3629 Poznanski A.K.	1836 Radcliffe C.A.	2924 Rawlinson J.A.
3406 Prabhu V.K.	3313 Radcliffe J.	973 Raymond S.
1766 Prablanc C.	3034 Radeka V.	1358 Raymond S.
479 Pradhan A.H.	3327 Rademaker O.	447 Raynaud J.P.
160 Pranis Pranevich L.I.	120 Rader R.D.	635 Raynes E.P.
285 Prasad M.A.	3413 Rader R.D.	3116 Raynes E.P.
2899 Prasad N.	3414 Rader R.D.	2169 Raynor S.
1863 Prasad N.K.	47 Radhakrishnan S.	3229 Rebersek S.
1119 Prasad S.N.	2665 Radil Weiss T.	1247 Rechnitz G.A.
2275 Pratapa Reddy V.C.V.	38 Radin E.L.	364 Reclitis V.K.
763 Pratape Reddy V.C.V.	39 Radin E.L.	227 Reddy D.R.
303 Pratt J.O.R.	1430 Radin E.L.	303 Redman H.C.
1328 Predecki P.	1812 Radin E.L.	50 Reed C.M.
126 Predko K.G.	848 Raguzin R.M.	525 Reed O.M.
3038 Preece I.	2814 Rahmoeller G.	94 Reedyk C.W.
1653 Prefaut C.	770 Rainal A.J.	974 Reekie D.
3120 Prenna G.	3173 Rainer W.G.	2733 Rees R.C.
3493 Preobrazhenskiy R.K.	3562 Rainer W.G.	3265 Reese D.F.
1674 Pressey A.W.	1283 Raines J.K.	2058 Regan D.
210 Preston T.A.	2652 Raines J.K.	3209 Regan D.
1444 Preusse J.W.	710 Raiskina M.E.	2810 Regos L.
2904 Pribram H.W.	3008 Raiskina M.Y.	685 Reichardt W.
3467 Price D.R.	3203 Raiteri M.	3325 Reichert T.A.

985 Reichertz P.L.	592 Rieke R.J.	2426 Rohl D.
920 Reichmann M.	1967 Riekmann D.	3616 Rohland T.A.
3241 Reid J.M.	478 Rieppo R.	1536 Rolfe D.
2380 Reide F.	624 Ries P.	2388 Rolfe D.
2816 Reidemeister J.C.	1518 Riesenberger H.	3536 Rolly G.
3529 Reidenbach H.D.	2932 Rigamonti C.	3629 Roloff D.W.
971 Reiffen B.	1782 Rigaud D.	956 Romanenko G.I.
2529 Reinhard H.J.	2946 Rigdon R.H.	2763 Romanenko G.I.
2858 Reinig H.J.	818 Riggie G.C.	2850 Romero Sierra C.
11 Reisbick M.H.	3489 Rigler R.	1689 Ronken D.A.
1403 Reisse R.	145 Rijnbeek A.G.	2769 Rooney J.A.
3395 Reiter R.F.	1066 Rikmenspoel R.	3651 Roos D.
2464 Reklaitis V.K.	1004 Rikoski R.A.	2039 Rootenberg J.
1154 Relays E.	1813 Rim K.	2921 Rosadini G.
1262 Rembaum A.	2762 Rimpl G.	3176 Rosborough J.P.
1286 Remington R.D.	2951 Rink R.E.	2503 Rosch W.
252 Remole A.	2655 Rinzel J.	206 Roschke E.J.
552 Remond A.	3326 Ripps H.	1644 Roschke E.J.
552 Renault B.	811 Risley W.B.	272 Rose R.M.
1772 Renaut P.W.	2149 Rissanen J.	1061 Rose R.M.
1087 Rencher A.C.	445 Risso W.	1430 Rose R.M.
3166 Rencher A.C.	2606 Ritea H.B.	1812 Rose R.M.
1013 Rendell M.	2728 Ritter M.A.	2131 Rosen G.
895 Reneman R.S.	703 Riva C.E.	3303 Rosen G.
1879 Renger B.J.	1209 Rizell S.	3190 Rosen M.
279 Rentzhog U.	1828 Roach M.R.	3571 Rosen M.
2932 Renzi C.	1610 Robbins D.	2518 Rosen M.G.
2873 Repko J.D.	2184 Roberge F.A.	2519 Rosen M.G.
55 Repp B.	2382 Roberge J.K.	1052 Rosen R.
1055 Rescigno A.	1915 Roberto J.T.	2731 Rosen Y.V.
2575 Reshodko L.V.	1917 Roberto J.T.	2431 Rosenbaum A.
2613 Resnick S.B.	871 Roberts G.W.	458 Rosenbaum H.M.
2650 Resnikoff M.	2799 Roberts V.C.	60 Rosenberg A.E.
1955 Restelli G.	406 Roberts V.D.	1130 Rosenberg B.
3524 Reuter F.W.	843 Robertson A.R.	3172 Rosenberg R.M.
548 Reuter H.J.	1339 Robertson D.A.R.	2991 Rosenberg U.
2473 Reuter R.	1641 Robertson D.A.R.	3642 Rosenblit A.B.
2190 Revenko S.V.	636 Robertson G.	1609 Rosengren L.G.
2079 Revesz G.	1452 Robertson J.M.	3109 Rosengren L.G.
982 Reynal M.	2874 Robertson R.M.	896 Rosenkranz K.A.
214 Reynolds J.A.	1259 Robinson A.D.	1640 Rosenkranz K.A.
325 Reynolds Jr C.L.	1887 Robinson A.H.	2817 Rosenkranz K.A.
1821 Reynolds M.J.	430 Robinson A.L.	3049 Rosenthal A.R.
2407 Rezek M.	3278 Robinson A.L.	1577 Roshchupkin D.I.
1310 Rezhabek B.G.	917 Robinson B.G.	295 Rositano S.A.
242 Rezhabek R.G.	54 Robinson C.E.	3112 Rosmann M.
1657 Rhinewine M.	2964 Robinson D.A.	2878 Rosnagle R.S.
2871 Rhode W.S.	740 Robinson G.R.	149 Rosner D.E.
854 Rhodes N.L.	3236 Robinson H.P.	1423 Ross G.G.
1434 Ricchiuti N.V.	3082 Robinson H.T.	1808 Ross G.G.
1125 Ricciardi L.M.	1728 Robinson J.L.	3063 Ross J.F.
769 Rice S.O.	3089 Robinson M.T.	3180 Ross J.N.
797 Rice S.O.	2871 Robles L.	1213 Ross W.D.
2116 Richalet J.	1490 Rochelle J.M.	2419 Rossi P.
3092 Richards J.C.	2242 Rochelle J.M.	2830 Rossing R.G.
3194 Richards J.H.	2364 Rochelle J.M.	127 Rossmann K.
2058 Richards W.	2151 Rockmore A.J.	266 Rostoker W.
2009 Richardson H.C.	2908 Roddy T.	3238 Rothenberg L.N.
1049 Richardson I.W.	997 Rodenbeck M.	695 Rothenberg M.
413 Richardson T.	3680 Rodenrys J.	1100 Rothman H.B.
1079 Richmond P.	3626 Rodi M.	1254 Rothwell P.S.
2126 Richter G.	3580 Rodrigues Lima J.	723 Rotshenker S.
2072 Richter R.	854 Roeder S.B.W.	1696 Rouge J.C.
865 Richter U.	3546 Roehl D.	3444 Rougny R.
948 Richter U.	3564 Roehl D.	1028 Rouse W.B.
3464 Riddle H.C.	1287 Roelandt J.	627 Rowan J.O.
3422 Rideout C.B.	2540 Roelandt J.	3406 Rowe H.E.
1512 Ridgeley A.	3233 Roemer R.	3046 Rowe W.J.
3121 Ridgeley A.	1189 Rogers M.T.	1884 Rowland S.W.
3000 Ridges J.D.	817 Rogoff G.L.	544 Rowley B.A.
2534 Riedler L.	2414 Rohl D.	3525 Rowley B.A.

2718 Roy A.E.	1429 Saha S.	1627 Saumont R.
2909 Roy O.Z.	538 Sahlman K.	256 Saunders F.A.
1272 Roy R.	1454 Saidel G.M.	2637 Saunders J.C.
2645 Roy R.	1455 Saidel G.M.	2669 Saunders K.B.
2102 Rozenfeld M.	2933 Sainio K.	1424 Saura Mendoza E.
1127 Rozenshtraukh L.V.	1253 Saito G.E.	2148 Savage J.E.
2033 Rozenshtraukh L.V.	3621 Saito S.	3089 Saville G.W.
2360 Rozsa A.	442 Sakharov V.K.	374 Savoie R.E.
2948 Rubin A.L.	850 Sakharov V.N.	1513 Sawada N.
1685 Rubin M.L.	3345 Sakrison D.J.	601 Sawai Y.
2647 Rubinow S.I.	69 Sakson M.E.	3047 Sawatari T.
3350 Rubissow G.J.	2811 Sakson M.Y.	1505 Sawchuk A.A.
2462 Ruchkin D.S.	2076 Sakurai T.	3128 Sawyer D.W.
1435 Ruckert K.H.	1179 Sakurai Y.	2736 Saxon D.H.
1066 Rudd W.G.	1815 Sakurai Y.	1886 Sayers D.C.J.
56 Rudgers A.J.	378 Sakvarelidze L.G.	2495 Sayler C.B.
1898 Rudyavskaya I.G.	1539 Salazar A.C.	2785 Sbresny W.
1679 Ruhrberg W.	211 Salazkin V.N.	2533 Scanlon G.T.
442 Rukman G.I.	230 Salcman M.	2609 Schacknow P.N.
2648 Rumberger Jr J.A.	231 Salcman M.	3382 Schaefer E.
2207 Runge G.	3196 Saling E.	1055 Schafer D.E.
409 Runova N.A.	738 Salisbury L.L.	203 Schafer R.W.
2619 Rupert A.L.	2178 Sallemi M.I.	1276 Schaldach M.
3138 Rupnik P.	154 Sallos J.	1640 Schaldach M.
1579 Rupp T.D.	600 Salmon D.	3281 Schaps P.
3530 Ruppin H.	3106 Salmon J.M.	100 Schar F.
2015 Ruschitzka E.	521 Saltzman R.S.	647 Scharf J.H.
1578 Rusetskii Y.S.	2527 Salu Y.	1344 Scharner W.
883 Russell G.	269 Salvati E.	2008 Schauble M.K.
2755 Russo F.	422 Salvati M.J.	3592 Schauer M.
1634 Rustan P.L.	1488 Salvati M.J.	598 Schaum K.D.
396 Rustichelli F.	2587 Salvi R.J.	3046 Schear H.E.
1645 Rusy B.F.	3482 Samartsev A.G.	3505 Scheel H.E.
2785 Rutenfranz J.	3683 Samek M.	1297 Schehl R.
575 Rutkowski E.J.	682 Samosudova N.V.	3640 Scheider U.
2128 Rutledge J.E.	1590 Sampson T.E.	3641 Scheider U.
3461 Rutman J.	1369 Samson Dollfus D.	271 Scheifele S.J.
1961 Rutovitz D.	1776 Samuels S.L.	398 Schellens J.P.M.
835 Ryabinin A.D.	103 Samuelson G.	1780 Schemmann H.
2639 Ryan A.	2145 Sanathanan C.K.	1759 Schemmel R.
1721 Ryba E.	2165 Sanders A.J.	339 Scheraga H.A.
1631 Rybakov A.M.	1002 Sanders C.L.	522 Scheraga H.A.
1064 Rydell N.	990 Sanders W.J.	1120 Scherer P.W.
3627 Rytina K.	3000 Sanders W.J.	92 Schevey G.J.
1997 Rytz A.	893 Sanderson A.C.	3446 Schiavi E.
	3574 Sanderson D.R.	1879 Schick R.
2569 Saari J.T.	295 Sandler H.	12 Schieber D.
2235 Sabah N.H.	427 Sandler H.	2542 Schilder P.
2457 Sabah N.H.	2911 Sandman A.M.	819 Schilling K.
2480 Sabah N.H.	397 Sandor T.	1958 Schima F.J.
3120 Sacchi C.A.	3439 Sandor T.	1109 Schindler A.M.
3636 Sachdeva H.S.	368 Sands P.J.	2893 Schirmer M.B.
2667 Sachs F.	1862 Sankaranarayanan P.E.	599 Schlaeppi H.P.
1046 Sachs G.	1424 Sanpera Rosinol I.	3117 Schlag E.W.
2983 Sachs M.B.	244 Sansbury R.V.	2272 Schleemilch W.
2984 Sachs M.B.	1723 Santamore W.P.	696 Schlegel P.
2594 Sachs R.M.	1665 Sapp A.E.	953 Schlegel P.
737 Sachs S.D.	590 Sara C.A.	2086 Schleusener S.A.
583 Sack H.	2278 Saridis G.N.	1221 Schleyer H.
1211 Sackett P.B.	2557 Sarkisov G.N.	1893 Schliepe R.
3003 Sackin H.	2382 Sarles Jr F.W.	241 Schlondorff G.
3273 Sackner M.A.	1548 Sarma G.R.	941 Schlondorff G.
3661 Sadegh Zadeh K.	1548 Sarma T.S.	868 Schloss F.
194 Sadler C.	2548 Sasaki A.	1868 Schlosser K.
3173 Sadler Jr T.R.	3400 Satinsky V.P.	1860 Schlotzhauer K.
3562 Sadler Jr T.R.	1514 Sato H.	1495 Schlotzhauer K.G.
3033 Saeki B.	489 Sato I.	1873 Schlotzhauer K.G.
362 Sagal A.A.	2254 Sato T.	2416 Schmalzbach E.L.
1101 Sage A.P.	833 Sattarov D.K.	1383 Schmechel D.
1270 Sage B.H.	1450 Sattel W.	1788 Schmickl H.
2691 Saha R.K.	639 Sauer B.W.	1923 Schmid D.

881 Schmid Schonbein H.	1876 Schuster G.	3031 Shanks I.A.
1205 Schmid Schonbein H.	86 Schwab A.	3116 Shanks I.A.
2622 Schmidek M.E.	3500 Schweiger A.	1804 Shanmugam K.
1057 Schmidt B.	2017 Schweikert H.	3051 Shanmugam K.
2954 Schmidt B.	1824 Schweizer L.	3617 Shannon G.F.
1390 Schmidt D.H.	1711 Schwetman H.A.	2616 Shannon R.V.
2881 Schmidt G.P.	3232 Schwind J.A.	2652 Shapiro A.H.
1738 Schmidt K.	1760 Sciabassi R.J.	378 Shapiro M.K.
1763 Schmidt K.	1462 Scott A.C.	2567 Shapiro N.
2541 Schmidt K.	1667 Scott A.C.	1827 Shapley M.L.
3440 Schmidt K.H.	740 Scott B.I.H.	2104 Sharkey S.W.
1530 Schmidt K.P.	1604 Scott D.S.	2855 Sharma K.N.
1967 Schmidt K.P.	3581 Scott H.	1560 Sharma S.C.
1388 Schmidt M.	642 Scott J.	2752 Sharp G.R.
904 Schmitt G.	3306 Scott Jr H.L.	2350 Sharp R.R.
1706 Schmitt G.	2094 Scott P.	2917 Sharpe T.C.
2259 Schmutter B.	113 Scott R.N.	1833 Sharpless S.K.
2703 Schmutter B.	960 Scott R.N.	3028 Shaw B.H.
3288 Schmutz L.E.	3006 Scott R.N.	899 Shaw D.M.
1559 Schnatterly C.	3490 Scott W.R.	1765 Shaw K.
444 Schnatterly S.E.	3614 Scotto M.	1521 Shaw R.
1596 Schneider C.S.	1420 Scripcariu D.	69 Shcherbunov A.I.
3686 Schneider G.T.	2835 Secker Walker R.H.	2811 Shcherbunov A.I.
2701 Schneider H.J.	2178 Seeber A.M.	2108 Sheldrake A.
631 Schneider M.	1519 Seeber C.	1504 Sheler K.
2197 Schneider M.	2556 Segel L.A.	3259 Shen L.Y.L.
2328 Schneider M.V.	2707 Seib D.H.	2423 Shepard B.M.
2746 Schneider M.V.	2014 Seiberth H.J.	2024 Shepelev V.A.
3117 Schneider S.	2381 Seidel K.	2675 Shepherd W.L.
354 Schnittgrund G.D.	2517 Seidenschnur G.	1038 Sheppard J.G.
1541 Schoeffler J.D.	3348 Seidl R.A.	332 Sheppard R.J.
1735 Schoeffler J.D.	3317 Seifritz W.	2710 Sherafetdinova O.V.
3647 Schoenauer W.	613 Seipel L.	1675 Sherebrin M.H.
2976 Schoenfeld C.M.	675 Seireg A.	3083 Sheridan J.R.
1764 Schoenfeld R.L.	2963 Seireg A.A.	971 Sherman H.
2929 Schoknecht G.	205 Sekelj P.	507 Sherwood J.E.
3253 Scholz H.	124 Seko A.	1542 Sherwood R.J.
2268 Scholzke D.	2461 Selekman W.	2739 Shestakova S.N.
3067 Schon S.	3655 Selezneva N.D.	2749 Shestov A.N.
1204 Schopp W.W.	3475 Selig W.J.	2332 Shiffers L.A.
2009 Schopp W.W.	3255 Seligson D.	1714 Shigemura N.
3542 Schott O.	1849 Selij A.P.L.	664 Shih H.H.
2508 Schramm H.F.W.	1800 Selkow S.M.	492 Shilin B.V.
3050 Schramm J.	3117 Selzle H.L.	2731 Shilov V.N.
679 Schreiner K.E.	2321 Semenov V.A.	2219 Shimahara M.
1784 Schrenk H.	493 Semenova M.V.	485 Shimizu Y.
1848 Schreurs A.W.	2420 Semrad B.	2448 Shimizu Y.
1849 Schreurs A.W.	796 Senatorova L.S.	788 Shimoyama H.
3537 Schricker K.T.	2779 Senf G.	953 Shimosawa T.
3665 Schroer B.J.	663 Senmoto S.	762 Shimura M.
2788 Schubart G.	781 Sequin C.H.	929 Shimura M.
3469 Schubring C.	3201 Serafini M.	3584 Shinaberger J.H.
1880 Schueli A.A.	486 Serebryakov V.A.	3159 Shinohara K.
3561 Schuette W.H.	440 Seregin A.G.	321 Shippy R.L.
551 Schuijf A.	116 Seshadri K.S.V.	783 Shmarev E.K.
3643 Schulman E.L.	175 Sessler G.M.	2467 Shmelev L.A.
3263 Schulman J.	2771 Sessler G.M.	211 Shmeleva A.M.
3552 Schulman J.	2158 Seufert W.D.	409 Shneyder Y.G.
2424 Schulte H.D.	1768 Sewell Jr F.A.	1412 Shoemaker C.
2816 Schulte H.D.	497 Sexton M.C.	1046 Shoemaker R.L.
3215 Schulte R.	1561 Seyse R.J.	2070 Shoenberger R.W.
351 Schultz A.B.	289 Sezaki N.	2286 Shofner F.M.
352 Schultz A.B.	2310 Shabanova L.N.	1136 Shohami E.
353 Schultz A.B.	2322 Shabanova L.N.	1137 Shohami E.
238 Schultz R.L.	2376 Shafirir N.H.	1699 Shoji H.
3380 Schultz S.G.	3677 Shah S.	3521 Shope W.W.
1623 Schulz J.	2941 Shahar A.	899 Short R.
2429 Schulz W.P.	171 Shajenko P.	2099 Shortliffe E.H.
906 Schumann K.	3296 Shames D.M.	3389 Shoup D.
2040 Schumann K.	263 Shanks C.	2970 Shoup T.E.
152 Schuske C.L.	590 Shanks C.A.	3620 Shtilkind T.I.

1037 Shubert H.A.	1209 Skoogh B.E.	2710 Sokolova N.N.
89 Shubin H.	2479 Skopitz M.	951 Sokovishin V.A.
782 Shukurova R.M.	2339 Skrotskii G.V.	304 Solberg H.E.
2710 Shulman M.Y.	3411 Skutt H.R.	3405 Solberg L.E.
189 Shum F.Y.Y.	3418 Skutt H.R.	98 Soliman A.M.
1614 Shungskaya V.Y.	2665 Skvaril J.	753 Soliman A.M.
3161 Shuppe N.G.	2389 Slater K.	3338 Sollins K.R.
851 Shushkov A.G.	213 Slattery L.T.	3338 Sollins M.R.
934 Sia J.B.	1987 Slavic I.A.	1930 Sollish B.
3599 Sibley M.J.	2138 Slaymaker F.H.	3387 Sollorz S.
2921 Siccardi A.	2716 Slepenskova Y.Z.	1252 Solt C.W.
3495 Siddiqui A.S.	876 Slis I.H.	787 Som S.C.
870 Siddon T.E.	2863 Sloan Wilson R.	3077 Somasundaran P.
474 Sidenius G.	863 Slusser R.A.	784 Sameda C.G.
470 Sidorin K.K.	1847 Small A.D.S.	2213 Somers G.H.J.
2697 Sidorov A.N.	559 Small Jr A.M.	792 Sommargren G.E.
722 Siebenga E.	2614 Small Jr A.M.	439 Sonko V.N.
935 Siebenga E.	3566 Smalling R.W.	337 Sood A.K.
3134 Siegbahn K.	1151 Smallwood R.E.	683 Soong T.T.
2600 Siegel J.A.	2842 Smets P.	3315 Soong T.T.
2037 Siegel J.H.	927 Smirnov K.A.	1013 Soorani J.
2850 Sierhuis A.	3678 Smith C.	616 Sorkin A.
1926 Siglow J.	1320 Smith C.A.	51 Sorkin R.D.
2764 Signarbieux C.	454 Smith C.L.	3353 Sorrell F.Y.
2182 Silberberg A.	2720 Smith C.L.	563 Sortini A.J.
2185 Silberberg A.	1983 Smith D.	640 Sostarich M.
1969 Silk C.	3244 Smith D.B.	544 South F.E.
3197 Silkalns G.I.	2945 Smith D.C.	913 Spacek P.
2828 Silny J.	1381 Smith D.E.	2944 Spacek P.
892 Silva J.	3358 Smith E.J.	871 Spaeth E.E.
199 Silverman N.R.	3244 Smith E.P.	3171 Spaeth E.E.
1258 Silverstein R.	681 Smith E.R.	1000 Spahn H.
2121 Sim F.H.	652 Smith G.A.	1385 Spahr J.
1869 Sima H.	2878 Smith H.W.	2248 Spalding R.L.
3641 Simang B.	923 Smith J.B.	277 Spanne P.
3686 Simard J.M.	3199 Smith J.B.	1666 Spataru C.
673 Simkin A.	2120 Smith J.G.	1558 Spaulding J.D.
1279 Simmons E.M.	2920 Smith J.R.	1321 Speaks C.
953 Simmons J.	1705 Smith Jr M.C.	830 Spence J.
1440 Simmons J.A.	826 Smith L.	452 Spence R.
1615 Simmons J.B.	1206 Smith M.H.	2269 Spencer A.J.
895 Simmons N.	2152 Smith M.R.	88 Spencer H.J.
536 Simon B.R.	1573 Smith P.W.	895 Spencer M.P.
589 Simon R.	1217 Smith R.L.	917 Spencer R.M.
1648 Simon R.	3606 Smith R.S.	1046 Spennney J.G.
2020 Simpson A.W.	3607 Smith R.S.	845 Speranskaya N.I.
1711 Simpson J.	2597 Smith S.M.	609 Spicer C.C.
2049 Simpson W.	617 Smith V.	84 Spichall W.
1775 Sims Jr J.R.	1237 Smith W.F.	3125 Spiegel R.J.
3405 Singer D.H.	3372 Smits H.	3205 Spiegel R.J.
2607 Singer E.	491 Smolkin M.N.	308 Spiger C.C.
2210 Singh C.	1635 Smyth N.P.D.	243 Spillmann L.
2186 Singh M.	3326 Snapper A.G.	1392 Spiroules B.J.
2211 Singh N.	1582 Snelling G.F.	2761 Splichal Jr W.F.
1860 Singhal K.	2487 Snijders C.J.	3609 Spoor A.
1122 Singhal V.K.	161 Snyder A.W.	1298 Spragg R.G.
2137 Sinha A.K.	2172 Snyder A.W.	3084 Sprake C.H.S.
1399 Sinha N.K.	3349 Snyder A.W.	320 Sprinck L.
1301 Sinha R.P.	2187 Snyder D.	3300 Spring K.R.
1000 Sinn R.	2284 Snyder D.	1629 Springer A.D.
1601 Sinyor A.	2898 Snyder W.S.	2601 Springer S.P.
2757 Sipp B.	2024 Sobakin M.A.	741 Sprunger E.
2829 Sirs J.A.	1302 Soda T.	856 Spurny Z.
3189 Sistermans J.F.	1059 Soden P.D.	2774 Spurr C.L.
2991 Sjögren H.	1782 Sodini D.	1719 Srinivasan M.
538 Sjögren S.	2848 Soechting J.F.	3122 Srinivasan P.S.
704 Skalak R.	2518 Sokol R.J.	1115 Srinivasan R.
244 Skavenski A.A.	2519 Sokol R.J.	216 Staisch K.J.
2100 Sklansky J.	2988 Sokolich W.G.	2114 Stalberg E.
2153 Sklansky J.	1171 Sokol'skiy M.N.	3588 Stalberg E.
2160 Sklansky J.	3330 Sokolov V.S.	1308 Stamopoulos C.D.

1499 Stamopoulos C.D.	3492 Stevenin P.	2810 Strommer M.
2233 Stamopoulos C.D.	3413 Stevens C.M.	3679 Strong A.J.
2474 Stamopoulos C.D.	3414 Stevens C.M.	2479 Strong D.
1985 Stanef I.	1945 Stevens J.F.	1220 Strong J.
3579 Stanescu D.C.	188 Stevens K.N.	1686 Strong J.
1898 Stanevich A.Y.	1356 Stevens K.N.	1087 Strong W.J.
267 Stanitski C.L.	1489 Stevens P.	3166 Strong W.J.
2382 Stanley A.G.	2175 Stevens P.M.	127 Strubler K.
1401 Stanley K.W.	2433 Stevenson H.M.	125 Struzer R.L.
2815 Stanley T.H.	432 Stevenson R.J.	1197 Stuart Jr J.C.
1093 Stansfield E.V.	3495 Stewart D.	3598 Sturgeon R.D.
793 Stapleton T.T.	1800 Stewart N.F.	3122 Subramanian M.S.
282 Staring A.	2267 Stewart W.C.	110 Sucena Paiva J.P.
758 Stark G.	3064 Stewart W.C.	3083 Suchanek R.G.
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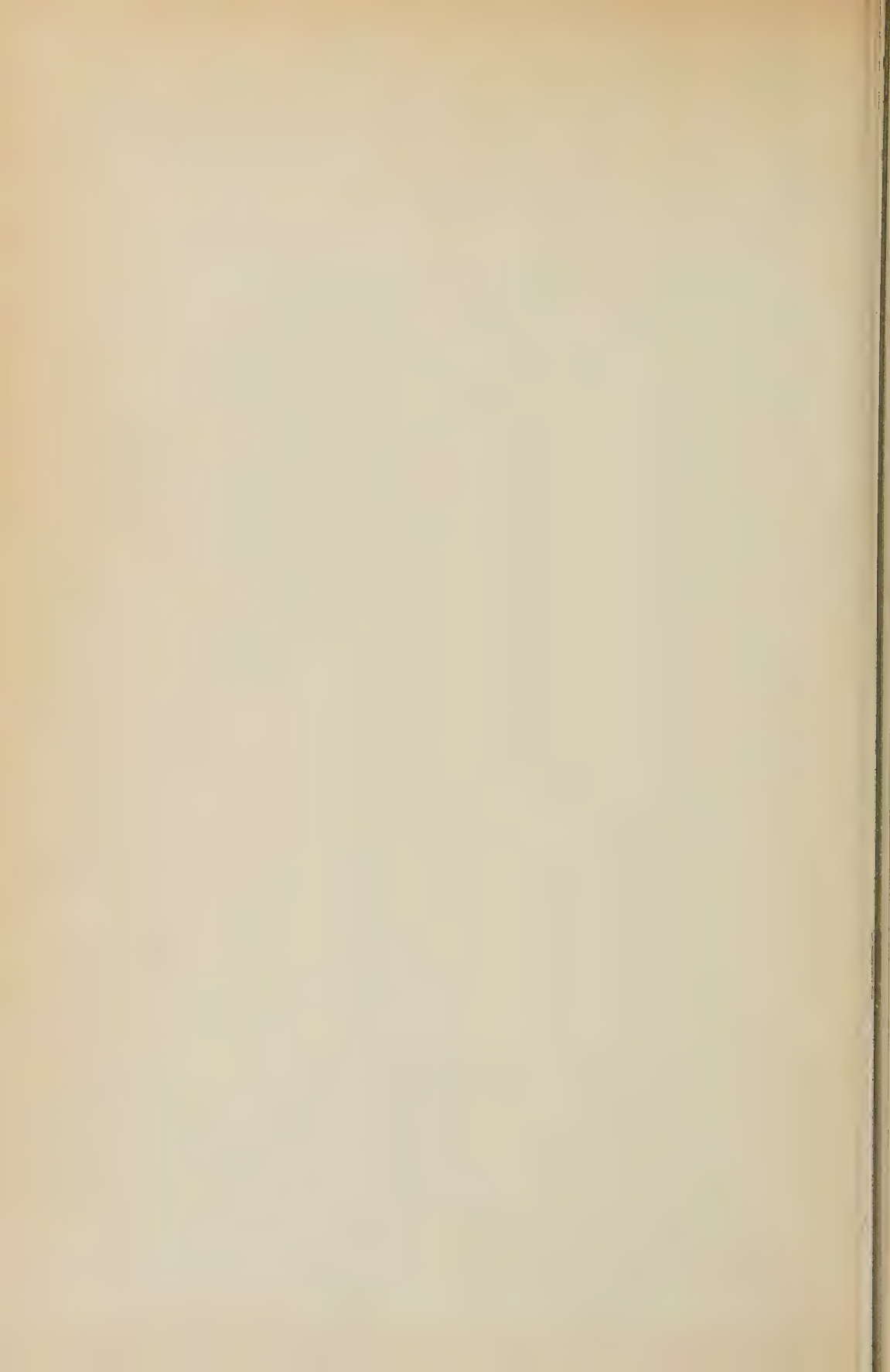
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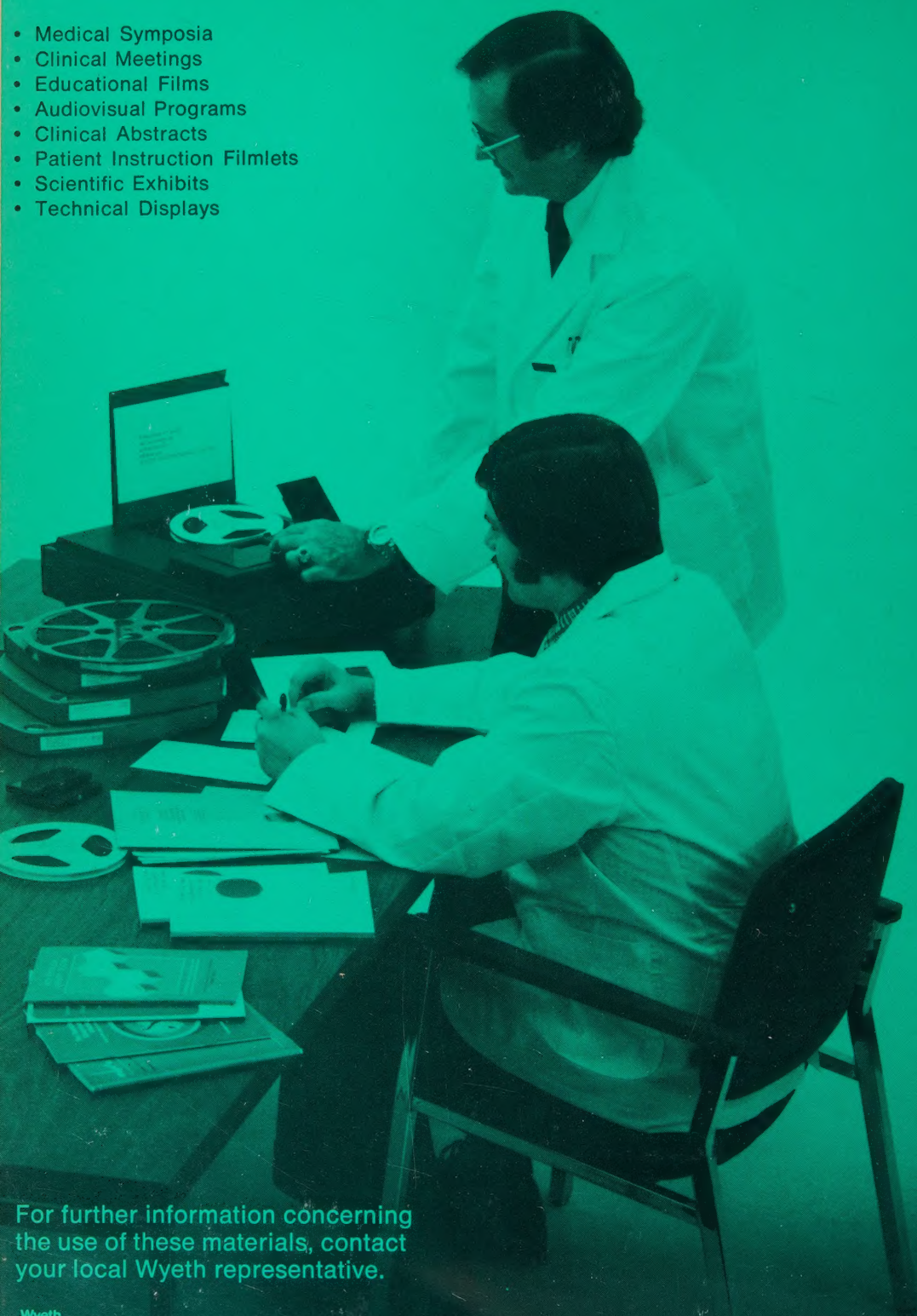
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